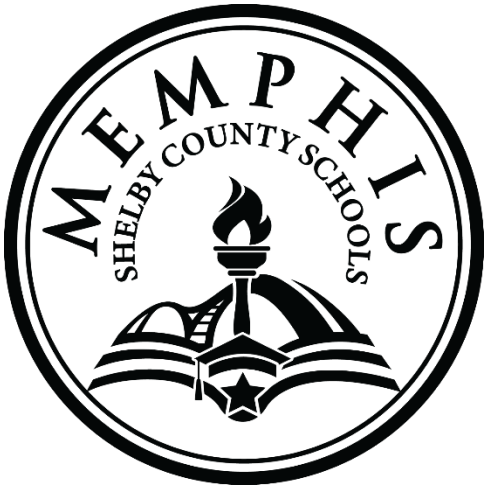
SUMMER SCHOOL TEACHER GUIDE



Physical Science

Summer School
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Summer School Teacher Guide

The Summer High School Program will be **20 days** for full credit and **10 days** for semester half (½) credit). First Semester will be **days 1-10** and Second Semester will be **days 11-20**. Breakdown of days will have the following per semester / half (½) credit:

- Nine (9) days of daily lessons
- One (1) day post-test review and post-test

All students and staff will use Grade Results for their summer curriculum. Each lesson will open daily, and students will not be able to work ahead; however, students can work on previously opened lessons per semester. Students can retake a daily post-test 3 times before it locks. If a student needs to retake a daily lesson post-test for a 4th time, then the teacher will have to open the lesson post-test again. Teachers should not delete any prior lesson post-test. Grade Results will post the highest grade from each students' lesson post-test.

HS Classroom Schedule – *Time below is an approximate breakdown of time.*

- **Attendance in PowerSchool** – 5 minutes
- **Lesson Introduction** (I Do) – 5 minutes
- **Lesson Activities/Supplemental** (We Do) – 60 minutes
- **Break – 10 Minutes** *(Site Administrator will work with teachers on breaks)*
- **Teacher Lesson Review** – 5 minutes
- **Independent Work** – Student Lesson Review*/Post-test (They Do) – 40 minutes
- **Closing/Wrap Up**– 5 minutes
- **Total Time: 2 hours 10 minutes**

***Lesson Review** – Students will review lessons for essential knowledge/information prior to the daily test.

The following will be used within **Grade Results**:

- Lessons with Content Area, Videos, and Activities
- Supplemental Teacher Resources App– Some lessons will have a Supplemental resource (Example – Flocabulary)
- Post-Test – Each lesson will have a daily post-test.

Graded Work – The Post-Test will be the daily graded work. Graded work is automatically calculated by the Grade Results Software.

Summer School Lesson Plan

Subject/Grade: Physical Science **Day: 1**

Topic/Lesson Title & Grade Results Lesson #: Lesson 1 - Phase Changes

Objective(s): Students will
1. Describe the movement of solid, liquid, and gas particles.
2) Identify the effect of temperature on kinetic energy
3) State the phase changes,
4) Analyze endothermic and exothermic processes,
5) Evaluate latent heat capacity.

Guiding Question(s): What causes matter to change states? How does gas behave under different conditions?

TN Curriculum Standard(s): Standard(s): PSCI.PS1.1 - Standard Description(s): Using the kinetic molecular theory and heat flow considerations, explain the changes of state for solids, liquids, gases.

Materials/Resources Needed: Grade Results Online Platform, Grade Results video, paper, pencil or notes in Grade Results

Technology: Computer, Whiteboard, TEAMs meeting (if applicable)

Attendance in PowerSchool – 5 minutes

Lesson Introduction (I Do) – 5 minutes
The teacher will review the standard, introduce the lesson, objectives, lesson vocabulary, and lesson activities.

Key Vocabulary Terms
Slide 14 – As a whole group, define and discuss the meaning of the vocabulary words

- **Boiling point:** The temperature at which the liquid form of a substance changes to its gaseous form at standard atmospheric pressure.
- **Condensation:** Process in which a gas is converted into a liquid.
- **Endothermic process:** Reaction which absorbs heat.
- **Equilibrium:** A state in which all the forces acting on an object are balanced. An object under such conditions is said to be in equilibrium or in a state of equilibrium.
- **Exothermic process:** Reaction which evolves heat.
- **Freezing point:** The temperature at which the liquid form of a substance changes to its solid form at standard atmospheric pressure.
- **Intermolecular forces:** Attractive or repulsive forces between molecules.
- **Kinetic energy:** Energy that an object possesses due to its motion.
- **Latent heat:** Heat energy associated with the change of phase of a substance without a change in temperature.
- **Melting point:** The temperature at which the solid form of a substance changes to its liquid form at standard atmospheric pressure.
- **Phase:** Physically distinctive form of matter, such as solid, liquid, and gas.
- **Sublimation:** Process in which solid changes directly into gas without first becoming a liquid.
- **Vaporization:** Process in which a solid or a liquid is converted into a vapor state.

Lesson Activities (We Do) – 60 minutes

As a whole group, complete the Practice Activities. The teacher and students will review the lesson content and complete the lesson activities on the following pages.
Slide 1 – Student will state objectives.
Slide 2 – Teacher will introduce the 4 states of matter & discuss the 11 visuals describing matter.
Slide 3 – Teacher will review The Kinetic Molecular Theory of Matter & Watch Video (3.07).
Slide 4 – Students will complete class activity on Compressibility of Solids, Liquids, and Gases.
Slide 5 – Teacher will review Phase Changes & complete activity with students.
Slide 6 – Teacher will review Phase Changes & Watch Video (1.07) & checks for understanding.
Slide 7 – Teacher will review Solids, Liquids, and Gases video (23.10) & checks for understanding.
Slide 8 – Students will complete Let Us Practice! activity.
Slide 9 – Teacher will review Latent Heat Capacity and Heat of Sublimation & checks for understanding.
Slide 10 – Students will complete activity on Phase Changes of Matter.
Slide 11 – Students will complete activity on Phase Changes.
Slide 12 – Students will complete activity on Changes of States.

Supplemental Activity (4:04 minutes) - Students will listen to Flocabulary States of Matter Video.

Break – 10 Minutes (Site Administrator will work with teachers on breaks)

Teacher Lesson Review – 5 minutes
Slide 13
Teacher will facilitate and guide students as they review lesson.

- As the temperature increases, the kinetic energy of the atoms or molecules in the matter increases…
- Endothermic process is one where a substance gains heat.
- Exothermic process is one where a substance loses heat.
- The heat energy associated with the change of phase of a substance, without a change in its temperature, is called latent heat.

- Have students review the slides and their notes to prepare for the Post-test

Independent Work – Student Lesson Review*/Post-test (They Do) – 40 minutes. Students will review lesson for essential knowledge/information prior to the daily test.
The students will complete the Lesson Posttest.
The teacher will explain to the students that they will be assessed on the Posttest and will work independently on the Posttest. The teacher will encourage all students to think critically and do their very best on the Posttest. The Posttest will count as the grade for the daily lesson.

Closing/Wrap Up– 5 minutes
The teacher will take a moment to reflect on the lesson of the day. The teacher will repeat selected concepts/content from the Lesson Review. The teacher may use an exit ticket: Ask students: What did you learn? What surprised you? What is unclear?

Total Time: 2 hours 10 minutes

Summer School Lesson Plan

Subject/Grade: Physical Science **Day: 2**

Topic/Lesson Title & Grade Results # Lesson 2 - The Gas Laws

Objective(s): Students will
1) Explain the kinetic theory of gases,
2) Explain Boyle's law, Charles's law, and Gay-Lussac's law.
3)Derive the combined gas law equation.
4) Describe Avogadro's number and Avogadro's law,
5) Derive the ideal gas law,
6) Use the internet and gather data about the Maxwell-Boltzmann distributions to display information and link the other information from the peaks.

Guiding Question(s): Among the states of matter, what is unique about gases? Do gases have mass and weight? How can you tell? Gases are considered fluids. Why?

TN Curriculum Standard(s): Standard: PSCI.PS1.2 Standard Description: Graphically represent and discuss the results of an investigation involving pressure, volume, and temperature of a gas.
Materials/Resources Needed: Grade Results Online Platform, Grade Results video, paper, pencil or notes in Grade Results

Technology: Computer, Whiteboard, TEAMs meeting (if applicable)

Attendance in PowerSchool – 5 minutes

Lesson Introduction (I Do) – 5 minutes
The teacher will review the standard, introduce the lesson, objectives, lesson vocabulary, and lesson activities.

Key Vocabulary/Terms:
Slide 22 – As a whole group, define and discuss the meaning of the vocabulary words

- **Avogadro's law:** Equal volumes of all gases at constant temperature and pressure contain equal number of molecules.
- **Boyle's law:** For a fixed mass of gas, the pressure is inversely proportional to the volume if the temperature remains constant. When the temperature is constant, the process is called an isothermal process.
- **Charles's law:** For a fixed mass of gas, the volume is proportional to the absolute temperature if the pressure remains constant. When the pressure is constant, the process is called the isobaric process.
- **Combined gas laws:** A combination of Boyle's, Charles's, and Gay-Lussac's laws.
- **Elastic collision:** A collision between two bodies in which neither of the bodies loses its kinetic energy. In other words, kinetic energy is conserved.
- **Frequency:** Number of events in a second.
- **Gay-Lussac's law:** The pressure of a gas is directly proportional to the Kelvin temperature if the volume remains constant.
- **Ideal gas law:** A combination of Boyle's, Charles's, and Avogadro's law.
- **Kinetic energy:** Energy possessed by an object due to its motion.

- Have students review the slides and their notes to prepare for the Post-test.

Lesson Activities/Supplemental (We Do) – 60 minutes

As a whole group, complete the Practice Activities. The teacher and students will review the lesson content and complete the lesson activities on the following pages.

Slide 1 – Student will state objectives.
Slide 2 – Teacher will introduce the 4 states of matter and use visuals and guiding questions to gauge what students already know about the lesson.
Slide 3 – Teacher will review Basic Assumptions of the Kinetic Molecular Theory of Gases.
Slide 4 – Teacher will review 3 Properties of Gases.
Slide 5 – Students will watch video on Matter (5:33) and teacher will check for understanding.
Slide 6 – Teacher will review and discuss Boyle's Law using the 3 visuals and checks for understanding.
Slide 8 – Teacher will review Charles's Law using the two visuals and checks for understanding.
Slide 6 – Teacher will review Boyle's Law using the three visuals and checks for understanding.
Slide 7 –Students will watch video on Boyle's Law (1:33) and teacher will check for understanding.
Slide 8 – Teacher will review Charles's Law using the two visuals and graph
Slide 9 – Students will watch video on Charles's Law (2:02) and teacher will check for understanding.
Slide 10 – Teacher will review Gay-Lussac's Law graph and 2 visuals.
Slide 11 – Students will watch video on Gay-Lussac's Law (3:16) & teacher will check for understanding.
Slide 16 – Teacher will review Ideal Gas Law and check for understanding.
Slide 17 – Students will watch video on Ideal Gas Law & teacher will check for understanding.
Slide 12 – Students will complete activity on Gay-Lussac's Law
Slide 13 – Teacher will review Combined Gas Law and check for understanding.
Slide 14 – Students will complete activity on Combined Gas Law.
Slide 15 – Teacher will review Avogadro's Number and check for understanding.
Slide 18 – Students will complete activity on Ideal Gas Law.
Slide 19 – Students will complete activity Let Us Practice.
Slide 20 – Students will complete activity on The Gas Laws.

Supplemental Activity (2:00 minutes) – Students will listen to The Gas Laws Video and discuss the concepts.

Break – 10 Minutes (Site Administrator will work with teachers on breaks)

Teacher Lesson Review – 5 minutes
Slide 21
Teacher will facilitate and guide students as they review lesson.

- According to Boyle's law, the pressure is inversely proportional to the volume if the temperature remains constant. When the temperature is constant, the process is called an *isothermal process*.
- According to Charles's law, the volume is proportional to the absolute temperature, if the pressure remains constant. When the pressure is constant, the process is called the *isobaric process*.
- According to Gay-Lussac's law, the pressure of a gas is directly proportional to the Kelvin temperature if the volume remains constant. When the volume is constant, the process is called the isochoric process.
- The combined gas law is a combination of Boyle's, Charles's, and Gay-Lussac's law.
- A mole of a substance is comprised of 6.02×10^{23} representative particles of that substance.
- According to Avogadro's law, equal volumes of all gases at constant temperature and pressure contain equal number of molecules.

- The ideal gas law is a combination of Boyle's, Charles's, and Avogadro's laws.

- Have students review the slides and their notes to prepare for the Post-test.

Independent Work – Student Lesson Review*/Post-test (They Do) – 40 minutes. Students will review lesson for essential knowledge/information prior to the daily test.
The students will complete the Lesson Posttest.
The teacher will explain to the students that they will be assessed on the Posttest and will work independently on the Posttest. The teacher will encourage all students to think critically and do their very best on the Posttest. The Posttest will count as the grade for the daily lesson.

Closing/Wrap Up– 5 minutes
The teacher will take a moment to reflect on the lesson of the day. The teacher will repeat selected concepts/content from the Lesson Review. The teacher may use an exit ticket: Ask students: What did you learn? What surprised you? What is unclear?

Total Time: 2 hours 10 minutes

Summer School Lesson Plan

Subject/Grade: Physical Science **Day: 3**

Topic/Lesson Title & Grade Results # Lesson 3 - Elements, Compounds, and Mixtures

Objective(s): Students will:
1. Differentiate between the three states of matter
2. Identify a given sample as either element, compound, or mixture
3. Classify substances as an element, a compound, and a mixture
4. Distinguish an element from a compound
5. Distinguish a compound from a mixture
6. Distinguish a homogeneous mixture from a heterogeneous mixture
7. Generate schematic models for comparison between elements, compounds, and mixtures

Guiding Question(s): What is Matter? How do you classify matter? Describe the three states of matter?

TN Curriculum Standard(s): Standard(s): PSCI.PS1.3**Standard Description(s):** Construct a graphical organizer for the major classifications of matter using composition and separation techniques.

Materials/Resources Needed: Grade Results Online Platform, Grade Results video, paper, pencil or notes in Grade Results

Technology: Computer, Whiteboard, TEAMs meeting (if applicable)

Attendance in PowerSchool – 5 minutes

Lesson Introduction (I Do) – 5 minutes
The teacher will review the standard, introduce the lesson, objectives, lesson vocabulary, and lesson activities.

Key Vocabulary/Terms
Slide 22 – As a whole group, define and discuss the meaning of the vocabulary words

- **Compound:** A substance formed by joining two or more different types of atoms.
- **Element symbol:** An abbreviation for an element.
- **Element:** A substance that contains only one type of atom.
- **Heterogeneous mixture:** A mixture with a non-uniform composition.
- **Homogeneous mixture:** A mixture with a uniform/same composition.
- **Matter:** Anything that has mass and volume.
- **Mixture:** A combination of two or more substances that are not chemically joined.
- **Molecule:** The smallest particle of a compound composed of chemically joined atoms.
- **Substance:** A type of matter with a fixed composition.
- **Gay-Lussac's law:** The pressure of a gas is directly proportional to the Kelvin temperature if the volume remains constant.
- **Ideal gas law:** A combination of Boyle's, Charles's, and Avogadro's law.
- **Kinetic energy:** Energy possessed by an object due to its motion.

- Have students review the slides and their notes to prepare for the Post-test.

Lesson Activities/Supplemental (We Do) – 60 minutes

As a whole group, complete the Practice Activities. The teacher and students will review the lesson content and complete the lesson activities on the following pages.

Slide 1 - Student will state objectives.
Slide 2 – Teacher will introduce Matter and uses guiding questions to gauge what students already about the matter. Students will complete activity on matter.
Slide 4 & 5 – Teacher will review and discuss Classification of Matter and check for understanding.
Slide 7 –Teacher will review and explain properties and classification of elements
Slide 9 –Teacher will review and discuss properties and classification of compounds.
Slide 11 –Teacher will review Properties and Classification of Mixtures on page 11 and explain the animated visuals.
Slide 12 –Students will complete activity on Differences Between Mixtures and Compounds.
Slide 13 – Students will watch video on mixtures and compounds teacher will check for understanding.
Slide 16 – Teacher will watch video on Elements, Compounds, and Mixtures (22:26) and checks for understanding during video.
Slide 8 – Students will complete the activity on Elements.
Slide 10 – Students will watch video on Compounds (0.59).
Slide 17 – Students will complete activity Schematic Models of Elements, Compounds, and Mixtures–
Slide 18 – Students will complete the Let's Practice Activity.
Slide 19 – Students will complete activity Identifying Elements, Compounds, and Mixtures.
Slide 20 – Students will complete an activity Elements, Compounds, and Mixtures.

Supplemental – N/A

Break – 10 Minutes (Site Administrator will work with teachers on breaks)

Teacher Lesson Review – 5 minutes
Slide 21
Teacher will facilitate and guide students as they review lesson.

- All matter has mass and volume. Based on their physical state, matters are classified into solids, liquids, and gases.
- Physical properties are those that can be observed without changing the chemical composition of the substance, and the changes associated with them are called physical changes.
- Chemical properties are those that can be observed only when a substance is changed into a new substance with different properties, and the change associated with it is called a chemical change.
- Based on their chemical composition, matters are classified into pure substances and mixtures.
- A pure substance is a type of matter with a fixed composition and constant properties.
- Pure substances are further classified into elements and compounds. Elements are the simplest substances, made up of only one kind of atom. Elements are further classified into metals, non-metals, and metalloids, and are organized in the periodic table. Elements may exist as either isolated atoms or molecules.
- Elements can be identified using both the physical and chemical properties.
- A compound is a pure substance formed by the chemical combination of two or more substances.
- Compounds are classified into ionic or covalent based on the types of bonds holding their atoms together.
- Ionic compounds have high melting and boiling points. Ionic compounds are highly soluble in water.

- Covalent compounds have low melting and boiling points. Covalent compounds, as a group, are the least soluble in water.
- A mixture is the physical combination of two or more substances.
- Mixtures are further classified into homogeneous and heterogeneous mixtures.
- A homogeneous mixture has a uniform composition.
- A heterogeneous mixture does not have a uniform composition.

- Have students review the slides and their notes to prepare for the Post-test

Independent Work – Student Lesson Review*/Post-test (They Do) – 40 minutes. Students will review lesson for essential knowledge/information prior to the daily test.
The students will complete the Lesson Posttest.
The teacher will explain to the students that they will be assessed on the Posttest and will work independently on the Posttest. The teacher will encourage all students to think critically and do their very best on the Posttest. The Posttest will count as the grade for the daily lesson.

Closing/Wrap Up– 5 minutes
The teacher will take a moment to reflect on the lesson of the day. The teacher will repeat selected concepts/content from the Lesson Review. The teacher may use an exit ticket: Ask students: What did you learn? What surprised you? What is unclear?

Total Time: 2 hours 10 minutes

Summer School Lesson Plan

Subject/Grade: Physical Science **Day: 4**

Topic/Lesson Title & Grade Results #: Lesson 4 - Physical and Chemical Changes

Objective(s): Students will

1. Explain the classification of matter.
2. Describe the physical and chemical properties of matter.
3. Explain material properties and conduct tensile testing for a project.
4. Describe physical and chemical changes, with examples.
5. Compare and contrast physical and chemical changes.
6. Investigate to classify the given changes in household products as either physical or chemical changes.

Guiding Question(s): What is matter? What are chemical and physical changes?

TN Curriculum Standard(s): Standard(s): PSCI.PS1.4 **Standard Description(s):** Apply scientific principles and evidence to provide explanations about physical and chemical changes.

Materials/Resources Needed: Grade Results Online Platform, Grade Results video, paper, pencil or notes in Grade Results
Technology: Computer, Whiteboard, TEAMs meeting (if applicable)

Attendance in PowerSchool – 5 minutes

Lesson Introduction (I Do) – 5 minutes
The teacher will review the standard, introduce the lesson, objectives, lesson vocabulary, and lesson activities.

Key Vocabulary/Terms
Slide 18 – As a whole group, define and discuss the meaning of the vocabulary words

- **Chemical change:** A change that results in the production of one or more new substances.
- **Chemical property:** Property of a substance that relates the ability of a substance to change into a new substance with different properties.
- **Matter:** Anything that has mass and occupies volume.
- **Physical change:** A change that does not alter the identity of a substance.
- **Physical property:** Property that can be observed and measured without changing the chemical composition of a substance.

Lesson Activities/Supplemental (We Do) – 60 minutes
As a whole group, complete the Practice Activities. The teacher and students will review the lesson content and complete the lesson activities on the following pages.
Slide 1 – Student will state objectives.
Slide 2 – Teacher will introduce the lesson and discuss physical changes relate to a candle burning.
Slide 3 – Teacher will discuss the table on classification of matter and check for understanding.
Slide 4 – Teacher will review Properties of Matter and checks for understanding.
Slide 5 – Watch Video - Material Properties (15.00) and check for understanding during video.
Slide 6 – Watch Video - Material properties and tensile testing. Students complete ordering activity.
Slide 7 – Teacher will review 7 visuals on the characteristics of physical change.

Slide 8 – Watch Video - physical changes (3.35 min).
Slide 8 – Students will complete 8 questions comparison activity.
Slide 9 – Students will complete activity on physical change.
Slide 11 – Watch Video - chemical changes (2.54 min).
Slide 12 – Students will complete activity on chemical change.
Slide 13 – Students will complete activity on comparing physical and chemical changes.
Slide 15 & 16 – Students will complete activity on physical and chemical changes.

Supplemental – N/A

Break – 10 Minutes (Site Administrator will work with teachers on breaks)

Teacher Lesson Review – 5 minutes
Slide 17
Teacher will facilitate and guide students as they review lesson.

- Properties are classified into physical and chemical properties.
- Odor, shape, volume, and density are examples of physical properties.
- Physical properties can be measured without changing the chemical composition of a substance.
- Chemical property relates the ability of a substance to change into a new substance.
- Reactivity, flammability, oxidation, reduction, and fermentation are examples of chemical properties.
- A physical change does not alter the identity of a substance.
- Physical changes are temporary and reversible in nature.
- Physical changes affect the physical property and do not affect the chemical property of a substance.
- Chemical changes are permanent and irreversible in nature.
- A chemical change in a substance produces one or more new substances, with different physical and chemical properties.
- An energy change takes place when a physical or a chemical change occurs
- Physical changes require less energy when compared to chemical changes.

- Have students review the slides and their notes to prepare for the Post-test

Independent Work – Student Lesson Review*/Post-test (They Do) – 40 minutes. Students will review lesson for essential knowledge/information prior to the daily test.
The students will complete the Lesson Posttest.
The teacher will explain to the students that they will be assessed on the Posttest and will work independently on the Posttest. The teacher will encourage all students to think critically and do their very best on the Posttest. The Posttest will count as the grade for the daily lesson.

Closing/Wrap Up– 5 minutes
The teacher will take a moment to reflect on the lesson of the day. The teacher will repeat selected concepts/content from the Lesson Review. The teacher may use an exit ticket: Ask students: What did you learn? What surprised you? What is unclear?

Total Time: 2 hours 10 minutes

Summer School Lesson Plan

Subject/Grade: Physical Science **Day: 5**

Topic/Lesson Title & Grade Results #: Lesson 5 - Atomic Theories

Objective(s): Students will

1. Describe the models and the experimental evidence for the five atomic theories.
2. Identify specific textual evidence from reading informational text which contains details that supports or challenges the five atomic theories.
3. Compare and contrast the atomic theories to determine if the findings support or contradict previous explanations of the atom model.

Guiding Question(s): What are atomic theories? What are atoms? What are atomic models?
TN Curriculum Standard(s): Standard(s): PSCI.PS1.5 **Standard Description(s):** Trace the development of the modern atomic theory to describe atomic particle properties and position.

Materials/Resources Needed: Grade Results Online Platform, Grade Results video, paper, pencil or notes in Grade Results

Technology: Computer, Whiteboard, TEAMs meeting (if applicable)

Attendance in PowerSchool – 5 minutes

Lesson Introduction (I Do) – 5 minutes
The teacher will review the standard, introduce the lesson, objectives, lesson vocabulary, and lesson activities.

Key Vocabulary/Terms
Slide 20– As a whole group, define and discuss the meaning of the vocabulary words

- **Atom:** The smallest basic unit of matter.
- **Compound:** A substance formed by joining two or more different types of atoms.
- **Electron:** A negatively-charged subatomic particle located outside the nucleus in an atom.
- **Electron Cloud:** The area around the atom's nucleus where the electrons are likely to be found.
- **Element:** A substance that contains only one type of atoms.
- **Proton:** A positively-charged subatomic particle located in an atom's nucleus.
- **Neutron:** A subatomic particle located in an atom's nucleus that has no electrical charge.
- **Nucleus:** The central part of an atom, which consists of protons and neutrons.

Lesson Activities/Supplemental (We Do) – 60 minutes
As a whole group, complete the Practice Activities. The teacher and students will review the lesson content and complete the lesson activities on the following pages.
Slide 1 - Student will state objectives.
Slide 2 – Teacher will introduce the lesson and discuss The Timeline Model.
Slide 3 – Teacher will review Greek Model of The Atom.
Slide 4 – Watch Video - Daltons Atomic Theory and check for understanding during video.
Slide 5 – Watch Theory video (2.03), and checks for understanding during video.
Slide 9 – Teacher will review and explain Millikan's Oil experiment.
Slide 10 – Teacher will review Rutherford's Gold Foil Experiment.

Slide 10 – Students will complete activity on Rutherford's Gold Foil Experiment.
Slide 11 – Watch Video - Rutherford's Gold Foil Experiment.
Slide 12– Teacher will review The Niels Bohr model.
Slide 13 – Watch Video - The Niels Bohr Model, and check for understanding during video.
Slide 14 – Teacher will review discovery of the Neutron.
Slide 15 – Watch Video - Discovery of the Neutron (2.52).
Slide 16 – Students will complete activity on Current Model.
Slide 17 – Watch Video - Electron Cloud Model.
Slide 17 – Students will complete drag and drop activity on Atomic Theories.

Supplemental (5:40 minutes) – – Students will listen to the Gas Laws video and discuss the concepts.

Break – 10 Minutes (Site Administrator will work with teachers on breaks)

Teacher Lesson Review – 5 minutes
Slide 19
Teacher will facilitate and guide students as they review lesson.

- The Greek philosopher Democritus suggested that matter is made of tiny indivisible particles called atomos.
- Aristotle opposed Democritus' idea and suggested that matter is made of 4 elements- Earth, Fire, Air, and Water.
- John Dalton proposed the basic postulates of atomic theory. His atomic model is called the "Billiard Ball model."
- Robert Millikan measured the charge of an electron.
- J.J. Thomson conducted a cathode ray experiment and discovered that the electrons are negatively charged particles. His model is called the "Plum Pudding Model."
- Ernest Rutherford conducted the Gold Foil Experiment and discovered the nucleus is small, dense. and positively charged.
- Niels Bohr proposed that the electrons orbit the nucleus in fixed orbits called shells.
- James Chadwick discovered the neutrons.
- Erwin Schrodinger suggested the Electron Cloud Model, where the electrons exist in probability clouds called orbitals.

- Have students review the slides and their notes to prepare for the Post-test

Independent Work – Student Lesson Review*/Post-test (They Do) – 40 minutes. Students will review lesson for essential knowledge/information prior to the daily test.
The students will complete the Lesson Posttest.
The teacher will explain to the students that they will be assessed on the Posttest and will work independently on the Posttest. The teacher will encourage all students to think critically and do their very best on the Posttest. The Posttest will count as the grade for the daily lesson.

Closing/Wrap Up– 5 minutes
The teacher will take a moment to reflect on the lesson of the day. The teacher will repeat selected concepts/content from the Lesson Review. The teacher may use an exit ticket: Ask students: What did you learn? What surprised you? What is unclear?

Total Time: 2 hours 10 minutes

Summer School Lesson Plan

Subject/Grade: Physical Science **Day: 6**

Topic/Lesson Title & Grade Results #: Lesson 6 - Isotopes

Objective(s): Students will

1. Describe the structure of an atom.
2. Depict proton, electron, and neutron.
3. Characterize the atomic nucleus.
4. Illustrate the mass and atomic numbers.
5. Explain isotopes.
6. Estimate the number of protons, electrons, and neutrons in isotopes.

Guiding Question(s): What are the particles of the atom? What's located in the nucleus of the atom? What are isotopes?

TN Curriculum Standard(s): Standard(s): PSCI.PS1.6 **Standard Description(s):** Characterize the difference between atoms of different isotopes of an element.

Materials/Resources Needed: Grade Results Online Platform, Grade Results video, paper, pencil or notes in Grade Results

Technology: Computer, Whiteboard, TEAMs meeting (if applicable)

Attendance in PowerSchool – 5 minutes

Lesson Introduction (I Do) – 5 minutes
The teacher will review the standard, introduce the lesson, objectives, lesson vocabulary, and lesson activities.

Key Vocabulary/Terms
Slide 24 — As a whole group, define and discuss the meaning of the vocabulary words

- **Atom**: Smallest particle that still retains the characteristics of the matter.
- **Electron**: Subatomic particle with negative charge.
- **Elements**: Pure substances which are made up of only one kind of atom.
- **Isotopes**: Two atoms of the same element, with different numbers of neutrons in their nuclei.
- **Lepton**: One of the elementary particles that participates in the weak interaction with the electron, muon, and associated neutrinos.
- **Muon**: Elementary particle that participates in the weak interaction.
- **Neutron**: Subatomic particle with no charge.
- **Nucleon**: Subatomic particle present in nucleus, namely protons and neutrons.
- **Proton**: Subatomic particle with positive charge.
- **Subatomic particles:** Atoms are composed of smaller particles called subatomic particles.

Lesson Activities/Supplemental (We Do) – 60 minutes
As a whole group, complete the Practice Activities. The teacher and students will review the lesson content and complete the lesson activities on the following pages.

Slide 1 – Student will state objectives.
Slide 2 – Teacher will introduce the lesson and discuss Atoms and Elements.
Slide 3 – Teacher will review Atoms and Elements and checks for understanding.
Slide 4 – Students will complete activity on Atoms and Elements
Slide 5 – Teacher will review Subatomic Particles and checks for understanding.
Slide 4 – Teacher will review Mass and Charge of the Subatomic Particles.
Slide 7 – Watch Video - Subatomic Particles (0.44sec)
Slide 8 – Students will complete activity on Subatomic Particles (5.00).
Slide 9 – Students will complete activity on Atomic Number and Mass Number.
Slide 10 – Watch Video - Atomic Number and Mass Number- (0.31)
Slide 11 – Students will complete activity on Atomic and Mass Number
Slide 12 – Watch Video - Discovery of Isotopes (0.38 sec) video.
Slide 13 – Watch Video - Isotopes - Isotopes of hydrogen (2.20) and check for understanding.
Slide 14 – Students will complete activity on Calculate the Number of Electrons, Protons, and Neutrons.
Slide 15 – Students will complete activity on Isotopes (5.00).
Slide 16 – Teacher will review Construction of Ball and Stick Models of Isotopes.
Slide 18 – Students will complete activity on Average Atomic Mass (5.00).
Slide 19 – Teacher will review Ions and checks for understanding.
Slide 20 – Teacher will review Radioisotopes and checks for understanding.
Slide 21 – Students will complete activity on Atoms and Isotopes.
Slide 22 – Students will complete activity on Atoms and Elements.
Supplemental (time) – N/A

Break – 10 Minutes (Site Administrator will work with teachers on breaks)

Teacher Lesson Review – 5 minutes
Slide 23
Teacher will facilitate and guide students as they review lesson.

- Matter is composed of tiny particles called atoms.
- The major subatomic particles are protons, electrons, and neutrons.
- One amu is defined as one-twelfth of the mass of an unbonded atom of carbon-12 ($_6C^{12}$) at rest.
- The charge of protons, electrons, and neutrons are, positive, negative and neutral respectively.
- The atomic nucleus is made of protons and neutrons. The nucleus holds the protons and neutrons together by strong nuclear force.
- Mass number = number of nucleons = atomic number + number of neutrons.
- Have students review the slides and their notes to prepare for the Post-test

Independent Work – Student Lesson Review*/Post-test (They Do) – 40 minutes. Students will review lesson for essential knowledge/information prior to the daily test.
The students will complete the Lesson Posttest.
The teacher will explain to the students that they will be assessed on the Posttest and will work independently on the Posttest. The teacher will encourage all students to think critically and do their very best on the Posttest. The Posttest will count as the grade for the daily lesson.

Closing/Wrap Up– 5 minutes
The teacher will take a moment to reflect on the lesson of the day. The teacher will repeat selected concepts/content from the Lesson Review. The teacher may use an exit ticket: Ask students: What did you learn? What surprised you? What is unclear?

Total Time: 2 hours 10 minutes

Summer School Lesson Plan

Subject/Grade: Physical Science **Day: 7**

Topic/Lesson Title & Grade Results #: Lesson 7 - The Periodic Table of Elements

Objective(s): Students will

1. Describe the periodic law.
2. Explain groups and periods in the periodic table.
3. Describe properties of metals, nonmetals, and metalloids.

Guiding Question(s): What is the periodic law? What is Mendeleev periodic law? What are metals?

TN Curriculum Standard(s): Standard(s): PSCI.PS1.7. Standard Description(s): Use the periodic table as a model to predict the relative properties of elements.

Materials/Resources Needed: Grade Results Online Platform, Grade Results video, paper, pencil or notes in Grade Results

Technology: Computer, Whiteboard, TEAMs meeting (if applicable)

Attendance in PowerSchool – 5 minutes

Lesson Introduction (I Do) – 5 minutes
The teacher will review the standard, introduce the lesson, objectives, lesson vocabulary, and lesson activities.

Key Vocabulary/Terms
Slide 15 – As a whole group, define and discuss the meaning of the vocabulary words

- **Atomic number (Z):** Number of protons in the nucleus of the atom of an element.
- **Boiling point:** The temperature at which the liquid form of a substance changes into vapor (gas), at standard atmospheric pressure.
- **Brittle:** A property that describes the ability of a material to break when subjected to pressure.
- **Conductivity:** A property that describes the ability of a material to transfer heat or electricity.
- **Ductility:** A property that describes the ability of a material to be drawn into thin wire without breaking.
- **Groups:** Elements arranged in vertical columns of the periodic table.
- **Isotopes:** Different atoms of the same element having the same atomic number but different mass number.
- **Luster:** A property that describes having a shiny appearance due to the reflection of light.
- **Malleability:** A property describing the ability of a material to be hammered or rolled into thin sheets.
- **Mass number (A):** The total number of protons and neutrons, i.e., the number of nucleons present in the nucleus.
- **Melting point:** The temperature at which the solid form of a substance changes to its liquid form at the standard atmospheric pressure.
- **Mendeleev periodic law:** The properties of the elements are periodic functions of their atomic masses.
- **Metalloids:** Elements which have some properties of metals and non-metals.

- **Modern periodic law:** The properties of the elements are periodic functions of their atomic numbers.
- **Periods:** The horizontal rows of elements in the periodic table.

Lesson Activities/Supplemental (We Do) – 60 minutes

As a whole group, complete the Practice Activities. The teacher and students will review the lesson content and complete the lesson activities on the following pages.
Slide 1 – Student will state objectives.
Slide 2 – Teacher will introduce the lesson and discuss the Periodic Table.
Slide 3 – Teacher will review Laws of Periodic Table (10 – 20 min) and check for understanding.
Slide 4 – Students will complete activity on Laws of Periodic Table.
Slide 5 – Teacher will review Classification of Elements and check for understanding.
Slide 6 – Students will complete activity on Groups and Periods – Students will complete activity.
Slide 7 – Students will complete activity on Groups and Periods drag & drop (5 – 15 min).
Slide 8 – Students will complete activity on Metals.
Slide 9 – Students will complete crossword puzzle on metals (4-7 min).
Slide 10 – Students will complete activity on Non-metals (4-6 min) – Students will complete activity.
Slide 11 – Teacher will review Metalloids and checks for understanding.
Slide 12 – Teacher will review video on The Periodic Table of Elements (37:23) and teacher will check for understanding.
Slide 13 – Students will complete activity on The Periodic Table of Elements.

Supplemental Activity (2:32 minutes) – Student will listen to Atoms and Elements video and discuss the concepts.

Break – 10 Minutes (Site Administrator will work with teachers on breaks)

Teacher Lesson Review – 5 minutes
Slide 14
Teacher will facilitate and guide students as they review lesson.

- Dmitri Mendeleev (1834-1907), a Siberian-born Russian chemist, was the first person (1869) to state the periodic law close to its present form.
- The Mendeleev periodic law states that properties of elements are a periodic function of their atomic masses.
- According to Moseley's periodic law, the properties of the elements are the periodic function of their atomic numbers.
- The periodic table lists elements in the order of increasing atomic number.
- The horizontal rows are called periods, and there are 7 periods in the periodic table.
- The vertical columns are called groups, and there are 18 groups in the periodic table.
- Elements can be classified into metals, non-metals, and metalloids in the periodic table.
- Reactivity of metals increases from right to left across a period in the periodic table.
- Reactivity of non-metals increases from left to right across a period in the periodic table.
- Some of the elements have both metallic and non-metallic characters, and they are called metalloids.
- Have students review the slides and their notes to prepare for the Post-test

Independent Work – Student Lesson Review*/Post-test (They Do) – 40 minutes. Students will review lesson for essential knowledge/information prior to the daily test.
The students will complete the Lesson Posttest.

The teacher will explain to the students that they will be assessed on the Posttest and will work independently on the Posttest. The teacher will encourage all students to think critically and do their very best on the Posttest. The Posttest will count as the grade for the daily lesson.

Closing/Wrap Up– 5 minutes
The teacher will take a moment to reflect on the lesson of the day. The teacher will repeat selected concepts/content from the Lesson Review. The teacher may use an exit ticket: Ask students: What did you learn? What surprised you? What is unclear?

Total Time: 2 hours 10 minutes

Summer School Lesson Plan

Subject/Grade: Physical Science **Day: 8**

Topic/Lesson Title & Grade Results #: Lesson 8 - Valence Electron and Bonds

Objective(s): Students will

1. Write the electronic configuration of elements, using the periodic table.
2. Explain the Lewis structure of atoms.
3. Predict the type of chemical bond based on the electronegativity value.
4. Describe valency of the element.
5. Predict the number of bonds based on the valency of an element.
6. Infer the meaning of symbols and key terms associated with texts about electron configuration and Lewis structures.
7. Determine the meaning of domain-specific phrases related to texts about chemical bonds.

Guiding Question(s): What are valence electrons? What is Lewis structure? What are cation and anions?

TN Curriculum Standard(s): Standard(s): PSCI.PS1.8. Standard Description(s): Using the patterns of electrons in the outermost energy level, predict how elements may combine**.**

Materials/Resources Needed: Grade Results Online Platform, Grade Results video, paper, pencil or notes in Grade Results

Technology: Computer, Whiteboard, TEAMs meeting (if applicable)

Attendance in PowerSchool – 5 minutes

Lesson Introduction (I Do) – 5 minutes
The teacher will review the standard, introduce the lesson, objectives, lesson vocabulary, and lesson activities.

Key Vocabulary/Terms
Slide 16 – As a whole group, define and discuss the meaning of the vocabulary words

- **Anion:** An atom or group of atoms that have a negative charge.
- **Atom:** The smallest basic unit of an element.
- **Cation:** An atom or group of atoms that have a positive charge.
- **Covalent bond:** The sharing of a pair of valence electrons by two atoms.
- **Electronegativity:** Property of an atom to attract the electrons of a bond.
- **Element:** A substance that contains only one type of atom.
- **Group:** Vertical column of elements on the periodic table of elements.
- **Ionic bond:** The bond formed by the transfer of outermost electron from one atom to another atom.
- **Lewis structure:** Representation of the electron arrangement in atoms, ions, or molecules, by showing the valence electrons as dots placed around the symbols for the elements.
- **Octet rule:** The tendency of atoms of elements to gain, share or lose electrons, so their valence shells are filled with eight electrons.
- **Orbital:** An allowed energy state for an electron.
- **Period:** Horizontal row of elements on the periodic table of elements.
- **Valence electrons:** The electrons present in the outermost energy level of an atom.

- **Valence orbital:** The orbital where the valence electrons are found.
- **Valence shell:** The outermost shell of an atom.
- **Valency:** Bonding capacity of a given atom.

Lesson Activities/Supplemental (We Do) – 60 minutes
As a whole group, complete the Practice Activities. The teacher and students will review the lesson content and complete the lesson activities on the following pages.
Slide 1 – Student will state objectives.
Slide 2 – Teacher will introduce the lesson and discuss sub-atomic particles.
Slide 3 – Teacher will review Classification of Elements and checks for understanding.
Slide 4 – Watch Video - The Periodic Table (5:19).
Slide 5 – Teacher will review Electron Configuration (shells subshells and orbitals).
Slide 6 – Teacher will review video on Electron Configuration and check for understanding
Slide 7 – Students will complete activity on Drag and Drop (Electron Configuration).
Slide 8 – Teacher will review Octet Rule and Duplet Rule.
Slide 9 – Teacher will review Lewis Structure and check for understanding.
Slide 10 – Watch Video - Lewis Structure video (0.54) and check for understanding.
Slide 11 – Students will complete activity on Lewis Structure.
Slide 12 – Teacher will review Chemical Bonds and Their Types and checks for understanding.
Slide 13 – Watch Video - Covalent Bond (2:58) and checks for understanding.
Slide 14 – Students will complete activity on Chemical Bonds and Their Types.
Supplemental – N/A

Break – 10 Minutes (Site Administrator will work with teachers on breaks)

Teacher Lesson Review – 5 minutes
Slide 15
Teacher will facilitate and guide students as they review lesson.
- Atoms are composed of protons, neutrons, and electrons.
- The periodic table organizes the elements by atomic numbers.
- Valence electrons are the electrons present in the outermost electron shell.
- Elements in the same group have the same number of valence electrons.
- Atoms can gain or lose electrons to achieve an octet configuration.
- Noble gases have 8 electrons (except helium) in their valence shell, and they are stable.
- Metals have a tendency to lose electrons and nonmetals have a tendency to gain electrons.
- A Lewis dot structure is the chemical symbol surrounded by a number of dots. Each dot represents a valence electron.
- Ionic bonds are formed by the transfer of outermost electron or electrons from one atom to another atom.
- Covalent chemical bonds involve the sharing of a pair of valence electrons by two atoms.
- Covalent bonds are classified into single, double, and triple covalent bond.
- Metallic bonding is the electromagnetic interaction between delocalized electrons, called conduction electrons, and the metallic nuclei within metals.
- The number of bonds made by a neutral atom can be predicted using the position of the atom in the periodic table.
- Have students review the slides and their notes to prepare for the Post-test

Independent Work – Student Lesson Review*/Post-test (They Do) – 40 minutes. Students will review lesson for essential knowledge/information prior to the daily test.
The students will complete the Lesson Posttest.
The teacher will explain to the students that they will be assessed on the Posttest and will work independently on the Posttest. The teacher will encourage all students to think critically and do their very best on the Posttest. The Posttest will count as the grade for the daily lesson.

Closing/Wrap Up– 5 minutes
The teacher will take a moment to reflect on the lesson of the day. The teacher will repeat selected concepts/content from the Lesson Review. The teacher may use an exit ticket: Ask students: What did you learn? What surprised you? What is unclear?

Total Time: 2 hours 10 minutes

Summer School Lesson Plan

Subject/Grade: Physical Science **Day: 9**

Topic/Lesson Title & Grade Results #: Lesson 9 - Chemical Reactions and Equations

Objective(s): Students will

1. Define a chemical change.
2. Classify the different types of chemical reactions.
3. Predict and name the products formed during a chemical reaction.

Guiding Question(s): What is a chemical change? What are products and reactants in a chemical reaction? What are the different types of chemical reactions?

TN Curriculum Standard(s): Standard(s): PSCI.PS1.11. Standard Description(s): Use models to identify chemical reactions as synthesis, decomposition, single-replacement, and double-replacement. Given the reactants, use these models to predict the products of those chemical reactions.

Materials/Resources: Grade Results Online Platform, Grade Results video, paper, pencil or notes in Grade Results

Technology: Computer, Whiteboard, TEAMs meeting

Attendance in PowerSchool – 5 minutes

Lesson Introduction (I Do) – 5 minutes
The teacher will review the standard, introduce the lesson, objectives, lesson vocabulary, and lesson activities.

Key Vocabulary/Terms
Slide 18 – As a whole group, define and discuss the meaning of the vocabulary words

- **Activity series**: List of metals arranged in their increasing order of reactivity.
- **Firework**: A class of explosive devices used for entertainment, cultural, and religious festival purposes.
- **Photosynthesis**: A process by which plants produce starch from carbon dioxide and water, using sunlight energy.
- **Precipitate**: Insoluble substance formed during a chemical reaction.
- **Products**: Substances that are formed as a result of a chemical reaction.
- **Reactants:** Substances that take part in a chemical reaction to create products.

Lesson Activities/Supplemental (We Do) – 60 minutes
As a whole group, complete the Practice Activities. The teacher and students will review the lesson content and complete the lesson activities on the following pages.
Slide 1 - Student will state objectives.
Slide 2 – Teacher will introduce the lesson and discuss chemical changes.
Slide 2 – Watch Video (1:01) video and checks for understanding.
Slide 3 – Teacher will review video (0.47) on Chemical Reactions.
Slide 4 – Teacher will review video Chemical reactions (2:54).
Slide 5 – Students will watch video on Five Types of Chemical Reaction and teacher will check for understanding.

Slide 6 – Students will watch video on Decomposition Reactions and teacher will check for understanding.
Slide 7 –Single Replacement Reactions-Activity Drag and Drop for Students. – Students will complete activity.
Slide 8 – Students will watch video on Single Replacement Reactions (3:14) and teacher will check for understanding.
Slide 9 – Teacher will review Double Replacement Reactions) and checks for understanding.
Slide 10 – Students will watch video on Double Replacement Reactions (3:12).
Slide 11 – Teacher will review Combustion Reactions and checks for understanding.
Slide 12 – Students will watch video on Combustion Reactions and teacher will check for understanding.
Slide 13 – Teacher will review Determination of Possible Reactants and Products.
Slide 14 – Students will complete activity Types of Chemical Reactions.
Slide 15– Students will complete activity Identifying Types of Chemical Reactions.
Slide 16 – Students will complete the activity on Chemical Reactions.
Supplemental (time) – N/A

Break – 10 Minutes (Site Administrator will work with teachers on breaks)

Teacher Lesson Review – 5 minutes
Slide 17
Teacher will facilitate and guide students as they review lesson.

- A chemical reaction is a chemical change that produces new products with different chemical compositions.
- Substances on the left side of the arrow of a chemical equation are the reactants. They react to form the products.
- Substances on the right side of the arrow of a chemical equation are the products. They are formed as a result of the reactants reacting with each other.
- In a synthesis reaction there is a combination of two or more substances, resulting in the formation of a new compound.
- A decomposition reaction breaks down a compound into simpler substances. It can be viewed as the opposite of a synthesis reaction.
- A single replacement reaction is when a single uncombined element replaces the cation in another compound.
- Double replacement reactions occur when the cation of one compound combines with the anion of another compound.
- Insoluble substances formed during a chemical reaction are called precipitates. Reactions which lead to the formation of precipitates are referred to as precipitation reactions.
- Acids neutralize bases to form salt and water. This is called neutralization reaction or an acid-base reaction.
- Chemical reactions in which gaseous product are evolved are called gas formation reactions.
- Combustion reactions occur when a substance combines with oxygen to form carbon dioxide, water, and/or other possible products.
- Have students review the slides and their notes to prepare for the Post-test

Independent Work – Student Lesson Review*/Post-test (They Do) – 40 minutes. Students will review lesson for essential knowledge/information prior to the daily test.
The students will complete the Lesson Posttest.
The teacher will explain to the students that they will be assessed on the Posttest and will work independently on the Posttest. The teacher will encourage all students to think critically and do their very best on the Posttest. The Posttest will count as the grade for the daily lesson.

Closing/Wrap Up– 5 minutes

The teacher will take a moment to reflect on the lesson of the day. The teacher will repeat selected concepts/content from the Lesson Review. The teacher may use an exit ticket: Ask students: What did you learn? What surprised you? What is unclear?

Total Time: 2 hours 10 minutes

Summer School Lesson Plan

Subject/Grade: Physical Science **Day: 10**

Topic/Lesson Title & Grade Results #: Final Post-Test Review & Post-Test

Objective(s):

- Students will review lessons to prepare for final Post-Test.
- Final Post-test will open. All students must complete the final Post-Test

Materials/Resources Needed: Grade Results Online Platform, Grade Results video, paper, pencil or notes in Grade Results

Technology: Computer, Whiteboard, TEAMs meeting (if applicable)

Lesson Introduction (I Do):
Identify the purpose of the course
Connect the course to missing or future coursework and Post-test

Lesson Activities/Supplemental (We Do) – 30-60 minutes

Lesson Activities and Review (We Do):
Check Grade Results and have students to review activities/lesson that they have not completed or need assistance with. Hold an open Q&A for students to ask questions regarding the activities/lessons they are reviewing.

Independent Work – Posttest (They Do):
Students will review and complete any incomplete/missed/failed coursework.

Closing/Wrap Up:

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Summer School Lesson Plan

Subject/Grade: Physical Science **Day: 11**

Topic/Lesson Title & Grade Results #: Lesson 1 - Forces and Laws

Objective(s): Students will

1. Define inertia and identify the properties of inertia of objects.
2. Describe Newton's three laws of motion.
3. Define force and explain how forces acting on an object relate to its motion.
4. Explain the relation between unbalanced force acting on an object and its acceleration based on Newton's second law.
5. Illustrate how forces appear in pairs and not isolated in nature with the help of Newton's third law of motion.

Guiding Question(s): What are Newton's laws of motion? What is force?

TN Curriculum Standard(s): Standard(s): PSCI.PS2.4**Standard Description(s):**
Plan and conduct an investigation to gather evidence and provide a mathematical explanation about the relationship between force, mass, and acceleration. Solve related problems using F=ma.

Materials/Resources Needed: Grade Results Online Platform, Grade Results video, paper, pencil or notes in Grade Results

Technology: Computer, Whiteboard, TEAMs meeting (if applicable)

Attendance in PowerSchool – 5 minutes

Lesson Introduction (I Do) – 5 minutes
The teacher will review the standard, introduce the lesson, objectives, lesson vocabulary, and lesson activities.

Key Vocabulary/Terms
Slide 17 – As a whole group, define and discuss the meaning of the vocabulary words

- **Acceleration:** The change in velocity with time.
- **Balanced force:** An equal pair of forces acting on opposite sides of an object that keeps the object in equilibrium.
- **Equilibrium:** The state in which all the forces acting on an object are balanced, or their net effect is zero.
- **Force:** A push or a pull upon an object that causes a change in a physical quantity.
- **Free-body diagram:** A picture that shows the direction and magnitude of all forces acting on an isolated object.
- **Friction:** The force that resists the motion of an object moving over the surface of another object.
- **Inertia:** The inability of an object to change from whatever state it currently is.
- **Resultant:** A single force that replaces the effects of all the other forces acting simultaneously on a rigid body.
- **Unbalanced force:** An unequal pair of forces acting on opposite sides of an object that causes a change in motion of an object.

Lesson Activities/Supplemental (We Do) – 60 minutes
As a whole group, complete the Practice Activities. The teacher and students will review the lesson content and complete the lesson activities on the following pages.

Slide 1 - Student will state objectives.
Slide 2 – Teacher will introduce the lesson and discuss Newton's First Law of Motion.
Slide 3 – Teacher will watch the 4:34 minutes video on Inertia and discuss video.
Slide 4 – Students will complete matching activity.
Slide 5 – Teacher will review Newton's First Law of Motion and checks for understanding.
Slide 6 – Teacher will review watch video on Newton's First Law of Motion (9:31).
Slide 7 – Teacher will review Equilibrium and checks for understanding.
Slide 8 – Students will complete activity on Equilibrium (drag and drop 4 items).
Slide 9 – Students will complete activity on Newton's Second Law of Motion.
Slide 10 –Teacher will review watch video on Newton's Second Law of Motion (7:13).
Slide 11 –Students will complete activity on Newton's Second Law of Motion.
Slide 12 – Students will complete activity on Newton's Second Law of Motion.
Slide 13 – Teacher will review Newton's Third Law of Motion and checks for understanding.
Slide 14 – Watch Video - Applications of Newton's Third Law (7:59).
Slide 15 – Students will complete activity on Newton's Third Law of Motion.
Slide 16 – Students will complete sorting activity.
Slide 17 – Students will complete Drag and Drop Activity.
Supplemental – N/A

Break – 10 Minutes (Site Administrator will work with teachers on breaks)

Teacher Lesson Review – 5 minutes
test
Slide 16
Teacher will facilitate and guide students as they review lesson.

- Inertia is an inherent property of all objects, and it is defined as the inability of an object to change by itself its state of rest, or of uniform motion along a straight line, or direction.
- The mass of an object is a quantitative measure of its inertia; the greater the mass, the greater it's inertia.
- Newton's first law, also known as the law of inertia, gives the proper definition of force.
- Force is an agent (a push or a pull) which can move an object from a rest position, stop an object in motion, change the direction of motion of an object, and increase or decrease the speed of an object (acceleration or deceleration).
- Newton's first law of motion states that every object continues in its state of rest or of uniform motion, along a straight line, unless it is compelled by an external force to change that state.
- According to Newton's second law, all objects undergo an accelerated motion when an unbalanced force acts on them.
- According to Newton's third law of motion, all forces appear in pairs. For every action, there is an equal and opposite reaction.
- Have students review the slides and their notes to prepare for the Post-test

Independent Work – Student Lesson Review*/Post-test (They Do) – 40 minutes. Students will review lesson for essential knowledge/information prior to the daily test.
The students will complete the Lesson Posttest.
The teacher will explain to the students that they will be assessed on the Posttest and will work independently on the Posttest. The teacher will encourage all students to think critically and do their very best on the Posttest. The Posttest will count as the grade for the daily lesson.

Closing/Wrap Up– 5 minutes

The teacher will take a moment to reflect on the lesson of the day. The teacher will repeat selected concepts/content from the Lesson Review. The teacher may use an exit ticket: Ask students: What did you learn? What surprised you? What is unclear?

Total Time: 2 hours 10 minutes

Summer School Lesson Plan

Subject/Grade: Physical Science **Day: 12**

Topic/Lesson Title & Grade Results #: Lesson 2 Conservative of linear momentum and collision

Objective(s): Students will

1. Define momentum.
2. Relate the impulse of force to Newton's second law.
3. Discuss the implications of impulse-momentum in everyday life.
4. Discuss the law of conservation of momentum based on Newton's third law.
5. Distinguish between elastic and inelastic collisions citing suitable examples.
6. Discover the conservation of momentum using a simulation that recalls the concepts behind the conservation of momentum and elastic and inelastic collisions.

Guiding Question(s): What is momentum? What is the law of conservation of momentum?

TN Curriculum Standard(s): Standard(s): PSCI.PS2.5. **Standard Description(s):** 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.

Materials/Resources Needed: Grade Results Online Platform, Grade Results video, paper, pencil or notes in Grade Results

Technology: Computer, Whiteboard, TEAMs meeting (if applicable)

Attendance in PowerSchool – 5 minutes

Lesson Introduction (I Do) – 5 minutes
The teacher will review the standard, introduce the lesson, objectives, lesson vocabulary, and lesson activities.

Key Vocabulary/Terms
Slide 19 – As a whole group, define and discuss the meaning of the vocabulary words

- **Collision:** An instance of one moving object striking drastically against another, which results in an exchange of energy and a change of direction.
- **Elastic collision:** A collision in which there is no loss of kinetic energy.
- **Force:** A push or pull upon an object that causes a change in the physical quantity of the object.
- **Impulse:** The change in the linear momentum of an object.
- **Inelastic collision:** A collision in which there is a loss of kinetic energy.
- **Kinetic energy:** The energy possessed by a body by virtue of its motion.
- **Mass:** The amount of matter present in an object.
- **Velocity:** The rate of change of displacement.

Lesson Activities/Supplemental (We Do) – 60 minutes
As a whole group, complete the Practice Activities. The teacher and students will review the lesson content and complete the lesson activities on the following pages.
Slide 1 - Student will state objectives.
Slide 2 – Teacher will introduce the lesson on Momentum.
Slide 3 – Teacher will discuss Momentum and checks for understanding.

Slide 4 – Watch Video - Momentum (3:54) and checks for understanding.
Slide 5 – Teacher will review and discuss Impulse.
Slide 6 – Watch Video - Impulse and Momentum (2:08) and checks for understanding.
Slide 7 – Teacher will review Conservation of Linear Momentum and checks for understanding.
Slide 8 – Teacher will review and discuss Conservation of Linear Momentum (contd...).
Slide 9 – Teacher will review Collisions and checks for understanding.
Slide 10 – Students will complete activity on Perfectly Inelastic Collisions.
Slide 11 – Students will watch video Perfectly Inelastic Collisions (3:47).
Slide 12 – Teacher will review and discuss Inelastic Collisions and Conservation of Momentum.
Slide 13 – Teacher will review and discuss Elastic Collisions (contd...).
Slide 14 – Watch Video - Elastic and Inelastic Collisions (2:26) video.
Slide 16 – Teacher will review and discuss Difference Between the Types of Collision.
Slide 17 – Students will complete activity - Conservation of Linear Momentum and Collisions.

Supplemental Activity (20 minutes) – Student will watch Momentum Video and discuss.

Break – 10 Minutes (Site Administrator will work with teachers on breaks)

Teacher Lesson Review – 5 minutes
Slide 18
Teacher will facilitate and guide students as they review lesson.

- Momentum can be defined as "mass in motion."
- A small object moving with a very high velocity has a large momentum.
- The momentum of an object depends upon two variables, its mass and its velocity, i.e., momentum $p = mv$. It is a vector quantity, and it is expressed in kg m/s.
- The momentum of an object changes due to the change in velocity of the object.
- The greater the force acting on the object, the greater the change in its velocity.
- The effect of force on an object depends on the magnitude of the force, the time interval for which the force acts, and the direction of the force.
- The product of force and the time interval for which a force acts on an object is the impulse of the force, i.e., impulse of the force = $F\Delta t$.
- Impulse is a vector quantity and has the same unit of momentum as kg m/s.
- Newton's second law states that the rate of change of momentum of an object is directly proportional to the resultant external force, and it is in the direction of the resultant external force, i.e., $\mathbf{F} = \frac{\Delta p}{\Delta t}$
- $F\Delta t = \Delta p$ is called the impulse-momentum theorem.
- A collision is an isolated event in which two or more colliding objects exert strong forces on each other for a short interval of time.
- Newton's third law states that the action and the reaction are always equal in magnitude and opposite in direction.
- The law of conservation of linear momentum states that the total momentum of a system of two or more interacting objects in the absence of an external force remains constant.
- In a collision acting to two objects, if the forces between the two objects are equal in magnitude and opposite in direction, then, $F_1t_1 = - F_2t_2$ alternatively
- $m_1 \times \Delta v_i = - m_2 \times \Delta v_f$
- i.e., $[m_1v_{1f} - m_1v_{1i} = - (m_2v_{2f} - m_2v_{2i})]$
- In an elastic collision between two objects, the momentum, the kinetic energy, and the total energy of the interacting system is conserved.

- In an inelastic collision between two objects, the momentum and the total energy of the interacting system are conserved, whereas the kinetic energy is not conserved because some kinetic energy is converted to internal energy when the objects deform.
- A rubber ball colliding with a hard surface is an inelastic collision, as some of the kinetic energy of the ball is lost when the ball is deformed.
- The collision of billiard balls in a game of pool is an example of elastic collision.
- Have students review the slides and their notes to prepare for the Post-test

Independent Work – Student Lesson Review*/Post-test (They Do) – 40 minutes. Students will review lesson for essential knowledge/information prior to the daily test.
The students will complete the Lesson Posttest.
The teacher will explain to the students that they will be assessed on the Posttest and will work independently on the Posttest. The teacher will encourage all students to think critically and do their very best on the Posttest. The Posttest will count as the grade for the daily lesson.

Closing/Wrap Up– 5 minutes
The teacher will take a moment to reflect on the lesson of the day. The teacher will repeat selected concepts/content from the Lesson Review. The teacher may use an exit ticket: Ask students: What did you learn? What surprised you? What is unclear?

Total Time: 2 hours 10 minutes

Summer School Lesson Plan

Subject/Grade: Physical Science **Day: 13**

Topic/Lesson Title & Grade Results #: Lesson 3 - Work Energy and Power

Objective(s): Students will

1. Discuss work done in different dimensions.
2. Explain energy and power.
3. Describe the relation between work and energy.

Guiding Question(s): What are the various forms of energy? What is work?

TN Curriculum Standard(s): Standard(s): PSCI.PS3.1 **Standard Description(s):** Identify and give examples of the various forms of energy (kinetic, gravitational potential, elastic potential) and solve mathematical problems regarding the work-energy theorem and power.

Materials/Resources Needed: Grade Results Online Platform, Grade Results video, paper, pencil or notes in Grade Results

Technology: Computer, Whiteboard, TEAMs meeting (if applicable)

Attendance in PowerSchool – 5 minutes

Lesson Introduction (I Do) – 5 minutes
The teacher will review the standard, introduce the lesson, objectives, lesson vocabulary, and lesson activities.

Key Vocabulary/Terms
Slide 13 – As a whole group, define and discuss the meaning of the vocabulary words

- **Displacement:** Shortest distance from the initial to the final position of an object.
- **Distance:** The actual path covered by an object.
- **Energy:** The ability to do work.
- **Force:** A push or pull upon an object resulting from the object's interaction with another object.
- **Friction:** Resistance encountered when an object is moving over another.
- **Gravitational potential energy:** Energy possessed by an object due to its elevation (height) relative to a lower elevation.
- **Gravity:** Force that attracts any object toward the center of Earth.
- **Internal work:** Work is done within the same system.
- **Isolated system:** A system that does not interact with its surrounding; its total energy and mass remaining constant.
- **Kinetic energy:** Energy possessed by an object by virtue of its motion.
- **Matter:** Anything that has a definite mass and volume.
- **Mechanical energy:** Energy associated with the motion and position of an object.
- **Momentum:** The product of mass (m) and velocity (v).
- **Position vector:** A vector that represents the position of an object.
- **Potential energy:** The energy stored in an object by virtue of its position or the state of strain.
- **Resistance:** Ability to prevent something from having an effect.
- **Speed:** Rate at which someone or something moves or travels.
- **Vector resolution:** Process of splitting a vector into various components.
- **Vector:** A quantity that has both magnitude and direction.

- **Velocity:** The rate of change of displacement.

Lesson Activities/Supplemental (We Do) – 60 minutes
As a whole group, complete the Practice Activities. The teacher and students will review the lesson content and complete the lesson activities on the following pages.
Slide 1 - Student will state objectives.
Slide 2 – Teacher will introduce the lesson and discuss work, energy, and power.
Slide 4 – Teacher will review Work Done in Three Dimension.
Slide 5 – Students will watch video on Energy (3:55) and teacher will check for understanding.
Slide 6 – Students will watch video on Potential Energy (2:49) and teacher will check for understanding.
Slide 7 – Students will watch video on Kinetic Energy (3:34) and teacher will check for understanding.
Slide 8 – Students will complete activity on Relation Between Work and Energy.
Slide 9 – Teacher will review Power and check for understanding
Slide 10 – Teacher will review selected sections video on Work and Energy (49:07) and teacher will check for understanding during the video.
Slide 11 – Students will complete activity on Work and Energy.

Supplemental Activity – (9:13) Students will watch video on work and energy and discuss the video.

Break – 10 Minutes (Site Administrator will work with teachers on breaks)

Teacher Lesson Review – 5 minutes
Slide 12
Teacher will facilitate and guide students as they review lesson.

- Work is done only when a force moves an object in a specific direction.
- The force you exert on an object can cause the object to move if it is at rest or change the direction of the object if it is in motion.
- When a force is applied on an object, and if the object does not move, then there is no work.
- If the force applied on an object can overcome a resistance force, such as friction and gravity, then the object will have a displacement.
- Work is described by the relation: W = F. Δ*d joules*
- Work is a scalar quantity; work can be zero, greater than zero, or less than zero.
- The applied force on an object is called the external force.
- When work is done by external forces, the total mechanical energy of the object is changed.
- Work done can be either positi*ve* work or negative work.
- If the force and the displacement are in the same direction, then positive work is done on the object; the object subsequently gains mechanical energy.
- If the force and the displacement are in the opposite direction, then negative work is done on the object; the object subsequently loses mechanical energy.
- Work in three dimension is calculated by the relation: $W = \int_a^b \overline{F}.\,d\overline{r}\,joules$
- Energy is the ability, or the capacity, or the power to do work, or the ability to move an object of some mass by applying a force to it, or a non-material property capable of causing changes in matter.
- The SI unit of energy is joule (J).
- According to the law of conservation of energy, energy is transformed from one form to another in an isolated system; energy can neither be created nor destroyed. The sum of all energies in an isolated system remains constant.
- Energy can be grouped into two major categories: potential energy and kinetic energy.
- The energy of an object associated with either the motion or the position of an object is called the mechanical energy of the object, or the energy in mechanical form is called mechanical energy.

- Mechanical energy that an object has by virtue of its position is called potential energy. It is determined by using the formula mgh.
- Mechanical energy that an object has by virtue of its motion is called kinetic energy. It is determined by using the formula $\frac{1}{2}mv^2$.
- The relation between kinetic energy and momentum of an object is: $KE = \frac{p^2}{2m}$
- Relation between work and energy is represented as follows:
- $W = \frac{1}{2}m\left(v_B^2 - v_A^2\right)$
- $W = \Delta KE = KE_f - KE_i$
- If an object's speed increases, then the work done on the object is positive and we say its kinetic energy has increased.
- If the object's speed decreases, then its kinetic energy decreases and the change in kinetic energy (ΔKE) is negative.
- If the object is not rigid and any of the forces acting on it deforms the object, then the Work-Energy Theorem will no longer be valid.
- The rate at which work is done by an agent is called power of that agent.
- $Power = \frac{Work\,done}{Time\,taken} = \frac{W}{t}$
- The SI unit of power is J/s or W (watt).
- The power of an agent at any time is called the instantaneous power (P). It is equal to the dot product of instantaneous velocity and the force acting at that instant: $P = \vec{F} \cdot \vec{v}$.
- Have students review the slides and their notes to prepare for the Post-test

Independent Work – Student Lesson Review*/Post-test (They Do) – 40 minutes. Students will review lesson for essential knowledge/information prior to the daily test.
The students will complete the Lesson Posttest.
The teacher will explain to the students that they will be assessed on the Posttest and will work independently on the Posttest. The teacher will encourage all students to think critically and do their very best on the Posttest. The Posttest will count as the grade for the daily lesson.

Closing/Wrap Up– 5 minutes
The teacher will take a moment to reflect on the lesson of the day. The teacher will repeat selected concepts/content from the Lesson Review. The teacher may use an exit ticket: Ask students: What did you learn? What surprised you? What is unclear?

Total Time: 2 hours 10 minutes

Summer School Lesson Plan

Subject/Grade: Physical Science **Day: 14**

Topic/Lesson Title & Grade Results #: Lesson 4 - Heat and Work

Objective(s): Students will

1. Define exothermic and endothermic reactions.
2. Differentiate heat capacity and specific heat of a substance.
3. Define activation energy of a chemical reaction.
4. Describe the various methods to measure the heat change (absorbed or released) during chemical reactions.
5. Define latent heat.

Guiding Question(s): What are exothermic and endothermic reactions? What is activation energy?

TN Curriculum Standard(s): Standard(s): PSCI.PS3.6 **Standard Description(s):** Determine the mathematical relationships among heat, mass, specific heat capacity, and temperature change using the equation $Q = mC_p\Delta T$.

Materials/Resources Needed: Grade Results Online Platform, Grade Results video, paper, pencil or notes in Grade Results

Technology: Computer, Whiteboard, TEAMs meeting (if applicable)

Attendance in PowerSchool – 5 minutes

Lesson Introduction (I Do) – 5 minutes
The teacher will review the standard, introduce the lesson, objectives, lesson vocabulary, and lesson activities.

Key Vocabulary/Terms
Slide 11 – As a whole group, define and discuss the meaning of the vocabulary words

- **Activation energy:** The minimum energy required to initiate a chemical reaction.
- **Bomb calorimeter:** A device used to measure the heat change (released or absorbed) in a chemical reaction by holding the volume constant and resisting large amounts of pressure.
- **Calorimeter:** An instrument used to measure the absorption or release of heat during a chemical reaction.
- **Endothermic reaction:** A reaction that absorbs energy in the form of heat from the surroundings.
- **Exothermic reaction:** A reaction that releases energy in the form of heat to the surroundings.
- **Heat capacity:** The amount of heat required to raise the temperature of a substance by 1 °C.
- **Latent heat:** The amount of heat required by a substance to change its physical state at constant temperature.
- **Latent heat of fusion:** The amount of heat required by a substance to change its physical state from solid to liquid at constant temperature.
- **Latent heat of vaporization:** The amount of heat required by a substance to change its physical state from liquid to gas at constant temperature.
- **Specific heat:** The amount of heat required to raise the temperature of one gram of a substance by one degree Celsius.
- **Thermochemistry:** The study of energy and heat transfer that takes place during the change of state and chemical reactions.

Lesson Activities/Supplemental (We Do) – 60 minutes
As a whole group, complete the Practice Activities. The teacher and students will review the lesson content and complete the lesson activities on the following pages.
Slide 1 - Student will state objectives.
Slide 2 – Teacher will introduce lesson, review and discuss Exothermic and Endothermic Reactions.
Slide 3 – Watch Video - Exothermic and Endothermic Reactions (1:11).
Slide 4 – Teacher will review Activation Energy Diagrams and checks for understanding.
Slide 5 – Watch Video - Heat Capacity and Specific Heat (3:28) and teacher will check for understanding.
Slide 6 – Teacher will review Calorimetry.
Slide 7 – Teacher will review Constant-Volume Calorimeters and checks for understanding.
Slide 8 – Students will review Latent Heat.
Slide 9 – Students will complete activity (Drag and Drop Activity).

Supplemental (time)
Teacher will review the following videos while checking for students understanding. Lesson 4 Supplemental Videos Lesson 4.2. Heat – Bill Nye The Science Guy (21:46); Khan Academy – Exothermic and endothermic reactions (11:29); Khan Academy – Exothermic and endothermic: Common processes and solved examples (6:11); Khan Academy – Heat transfer and thermodynamics (6:03).

Break – 10 Minutes (Site Administrator will work with teachers on breaks)

Teacher Lesson Review – 5 minutes
Slide 10
Teacher will facilitate and guide students as they review lesson.

- Heat flows from a hot region to a cold region.
- A chemical reaction involves transfer of heat (energy). Heat is either absorbed or released in a chemical reaction.
- In accordance with the law of conservation of energy, if the energy in a chemical reaction increases, the energy of the surroundings must decrease by the same amount (endothermic reaction). Similarly, if the energy in a chemical reaction decreases, the energy of the surroundings must increase (exothermic reaction).
- Heat is measured in calorie or joule (1 Cal = 4.184 J).
- Reactants in a chemical reaction require a minimum energy to initiate the reaction to form products. This minimum energy is called the activation energy.
- The heat capacity of a substance is the amount of heat required to raise its temperature by 1 °C.
- Specific heat C is the heat required to raise the temperature of one gram of a substance by one degree Celsius.
- Calorimetry is a technique that measures the heat involved in a chemical reaction. A calorimeter is an instrument to measure the absorption or release of heat during a chemical reaction.
- Enthalpy H is the heat content of a system at constant pressure. Enthalpy change ΔH is the heat absorbed or released by a system at constant pressure.
- ΔH is negative for an exothermic reaction and it is positive for an endothermic reaction.
- The difference between the enthalpy of substances at the end and beginning of a reaction is called enthalpy of the reaction.
- The device used to measure heat change in a chemical reaction at constant pressure (atmospheric pressure) is called constant-pressure calorimeter.
- The device used to measure the heat change in a chemical reaction at constant volume is called a bomb calorimeter.
- The heat given to a substance that does not increase its temperature but changes its physical state is known as latent heat. The heat given to a substance that changes its physical state from solid to liquid at

constant temperature is called the latent heat of fusion. The heat given to a substance that changes its physical state from liquid to gas at constant temperature is called the latent heat of vaporization.

- The specific latent heat or heat of transformation (L) of a material is a measure of heat released or absorbed during a phase change of 1 kg of material.
- The energy required for a phase change of a substance of mass m is given by Q = mL.
- Have students review the slides and their notes to prepare for the Post-test

Independent Work – Student Lesson Review*/Post-test (They Do) – 40 minutes. Students will review lesson for essential knowledge/information prior to the daily test.

The students will complete the Lesson Posttest.

The teacher will explain to the students that they will be assessed on the Posttest and will work independently on the Posttest. The teacher will encourage all students to think critically and do their very best on the Posttest. The Posttest will count as the grade for the daily lesson.

Closing/Wrap Up– 5 minutes

The teacher will take a moment to reflect on the lesson of the day. The teacher will repeat selected concepts/content from the Lesson Review. The teacher may use an exit ticket: Ask students: What did you learn? What surprised you? What is unclear?

Total Time: 2 hours 10 minutes

Summer School Lesson Plan

Subject/Grade: Physical Science **Day: 15**

Topic/Lesson Title & Grade Results #: Lesson 5 - Efficiency of Machines

Objective(s): Students will

1. Define a simple machine and a complex machine.
2. Explain the energy efficiency of a machine.
3. Calculate the energy efficiency of a machine.
4. Debate ways to improve the economic impact of everyday machines such as transportation vehicles on society.

Guiding Question(s): What is a simple machine? What is a complex machine?

TN Curriculum Standard(s): Standard(s): PSCI.PS3.4 **Standard Description(s):** Collect data and present your findings regarding the law of conservation of energy and the efficiency, mechanical advantage, and power of the refined device.

Materials/Resources Needed: Grade Results Online Platform, Grade Results video, paper, pencil or notes in Grade Results

Technology: Computer, Whiteboard, TEAMs meeting (if applicable)

Attendance in PowerSchool – 5 minutes

Lesson Introduction (I Do) – 5 minutes
The teacher will review the standard, introduce the lesson, objectives, lesson vocabulary, and lesson activities.

Key Vocabulary/Terms
Slide 14 – As a whole group, define and discuss the meaning of the vocabulary words

- **Energy:** The ability to do work.
- **Force:** A push or a pull upon an object that causes a change in a physical quantity.
- **Friction:** The force that resists the motion of an object moving over the surface of another object.
- **Gravity:** The force of attraction between the Earth and an object lying on or near the surface of the Earth.
- **Heat:** A form of energy, which is the result of the motion of the particles of the matter.
- **Inclined plane:** A plane slanting at an angle to the horizontal surface that is used to raise or lower a load by rolling or sliding.
- **Mechanical energy:** The energy associated with either the motion or the position of an object.
- **Lever:** A simple machine that contains a bar that rotates around a fixed point.
- **Pulley:** A wheel with a grooved rim in its center and fixed on an axle, in which a rope can be run to change the direction or point of application of a force applied to the rope; it is used to lift heavy objects.
- **Screw:** A short, slender, sharp-pointed metal pin with a raised helical thread running around it and a slotted head used to join things together by being rotated so that it pierces wood or other materials and is held tightly in place.
- **Wedge:** A block of solid material that is shaped like a narrow V in cross-section and can be pushed or driven between two objects or parts of an object in order to split or secure them.

- **Wheel and axle:** A machine made with two different-sized wheels that are connected and made to turn together.
- **Work:** The product of force and displacement.

Lesson Activities/Supplemental (We Do) – 60 minutes
As a whole group, complete the Practice Activities. The teacher and students will review the lesson content and complete the lesson activities on the following pages.
Slide 1 - Student will state objectives.
Slide 2 – Teacher will introduce the lesson and discuss Simple and Complex Machines.
Slide 3 – Students will complete activity on Simple Machines and Complex Machines.
Slide 4 – Watch Video - Simple and Complex Machines (6:11) and check for understanding.
Slide 5 – Teacher will review Mechanical Advantage of Simple Machines and checks for understanding.
Slide 6 – Teacher will review watch video on Mechanical Advantage (14:53).
Slide 7 – Students will complete activity on Calculating Mechanical Advantage.
Slide 8 – Watch Video - Calculating the Mechanical Advantage (14:53).
Slide 9 – Teacher will review Energy Efficiency of a Machine and check for understanding.
Slide 10 –Energy Efficiency of a Machine (contd...) – 1 table, 2 visuals.
Slide 11 – Teacher will review Calculating the Efficiency of Machines.
Slide 12 –Calculating the Efficiency of Machines (contd...) and teacher will check for understanding.
Slide 13 – Teacher will review watch video - Efficiency of Machines 2 videos, (1:57min) & (6:13min).
Slide 14 – Teacher will review Economic Impact of Transportation Vehicles – 1 visual & 1 paragraph.
Slide 15 – Students will complete activity on Electric Cars - Facts and Arguments & watch video (2:35).
Slide 16 – Students will complete activity on Electric Cars – Argumentation.
Supplemental (time) – N/A

Break – 10 Minutes (Site Administrator will work with teachers on breaks)

Teacher Lesson Review – 5 minutes
Slide 13
Teacher will facilitate and guide students as they review lesson.

- Any tool or a device with moving parts that work together to accomplish a task is called a *machine*.
- A simple machine has a few or no moving parts, and it uses energy to work.
- Complex machines are made of two or more simple machines, such as bicycles, automobiles, cranes, etc.
- An *input force* (F_i) is a force that is applied to the machine to make it work. This force is also called the *effort force* (F_e).
- An o*utput force* (F_o) is the force the machine provides. This force is also called the *resistance force* (F_r).
- The types of simple machines are an inclined plane, wedge, lever, screw, wheel and axle, and pulley.
- Mechanical advantage (MA) is a term used to describe the amplification of the input force by a simple machine.
- $$\text{Mechanical Advantage } \left(MA\right) = \frac{F_r}{F_e}$$
- The mechanical advantage for the ideal machine is called the ideal mechanical advantage (*IMA*).
- $Ideal\ mechanical\ advantage = \frac{d_i}{d_o}$; where,
- d_i is the distance the effort force acts through the machine, and
- d_o is the distance the resistance force acts through the machine.

- The mechanical advantage of a complex machine is the product of the mechanical advantages of the individual simple machines it is made of.
- A measure of the effectiveness of a machine in transforming the energy into useful energy is called the efficiency of the machine.
- The efficiency of a machine is also defined as the ratio of the output work to the input work.
- $$\text{Efficiency} = \frac{\text{Output work}}{\text{Input work}} = \frac{\text{Output energy}}{\text{Input energy}}$$
- The efficiency of a machine is always less than 100 percent.
- The objective of the efficiency of a machine is to reduce the amount of energy needed to provide products or services.
- Have students review the slides and their notes to prepare for the Post-test

Independent Work – Student Lesson Review*/Post-test (They Do) – 40 minutes. Students will review lesson for essential knowledge/information prior to the daily test.
The students will complete the Lesson Posttest.
The teacher will explain to the students that they will be assessed on the Posttest and will work independently on the Posttest. The teacher will encourage all students to think critically and do their very best on the Posttest. The Posttest will count as the grade for the daily lesson.

Closing/Wrap Up– 5 minutes
The teacher will take a moment to reflect on the lesson of the day. The teacher will repeat selected concepts/content from the Lesson Review. The teacher may use an exit ticket: Ask students: What did you learn? What surprised you? What is unclear?

Total Time: 2 hours 10 minutes

Summer School Lesson Plan

Subject/Grade: Physical Science **Day: 16**

Topic/Lesson Title & Grade Results #: Lesson 6 - Power: Production and Consumption

Objective(s): Students will

1. Define power.
2. Calculate the rate of energy production or consumption.
3. Examine power consumption and power production systems.

Guiding Question(s): What is work? What is mechanical energy?

TN Curriculum Standard(s): Standard(s): PSCI.PS3.4 **Standard Description(s):** Collect data and present your findings regarding the law of conservation of energy and the efficiency, mechanical advantage, and power of the refined device.

Materials/Resources Needed: Grade Results Online Platform, Grade Results video, paper, pencil or notes in Grade Results

Technology: Computer, Whiteboard, TEAMs meeting (if applicable)

Attendance in PowerSchool – 5 minutes

Lesson Introduction (I Do) – 5 minutes
The teacher will review the standard, introduce the lesson, objectives, lesson vocabulary, and lesson activities.

Key Vocabulary/Terms
Slide 16 – As a whole group, define and discuss the meaning of the vocabulary words

- **Electrical energy:** The energy produced by a flow of electric charge through a conductor.
- **Electromagnet:** A conductor attaining magnetic property due to a passing current.
- **Electromagnetic induction:** The process of generating current in a conductor by placing it in a changing magnetic field.
- **Fossil fuel:** A natural fuel derived from the remains of dead plants and animals of the previous geologic time.
- **Geothermal heat pump:** A ground source heat pump acts as a central heating and/or cooling system that transfers heat from or to the ground.
- **Mechanical energy:** The energy associated with either the motion or position of an object.
- **Non-renewable resource:** A resource that cannot be easily regenerated once it is destroyed.
- **Photovoltaic cell:** A cell that converts solar energy into electrical energy.
- **Renewable resource:** A resource that can be easily replaced in a short period.
- **Refrigerant:** Substance used for cooling or freezing.
- **Tower windmill:** A vertical windmill that is made of brick or stone, on which sits a wooden roof, which produces electricity from the wind energy by rotating the blades.
- **Work:** The product of force and displacement.

Lesson Activities/Supplemental (We Do) – 60 minutes
As a whole group, complete the Practice Activities. The teacher and students will review the lesson content and complete the lesson activities on the following pages.

Slide 1 - Student will state objectives.
Slide 2 – Teacher will introduce the lesson and discuss Energy Production and Power.
Slide 3 – Teacher will review Power and check for understanding.
Slide 4 – Teacher will review Power (contd...) and check for understanding.
Slide 5 – Students will watch video on Current Electricity.
Slide 6 – Students will complete activity on Power.
Slide 7 – Teacher will review Sources of Power and check for understanding.
Slide 8 – Students will watch video - Sources of Electricity (21:53). Teacher will check for understanding.
Slide 9 – Teacher will review Power Output or Rate of Energy Consumption Cost.
Slide 10 – Teacher will review Power Production and Consumption World's energy.
Slide 11 – Students will watch video on Alternative Energy Sources (24:07) Check for understanding.
Slide 12 – Teacher will review Power Production Systems.
Slide 13 – Teacher will review video on Solar Power (9:37).
Slide 14 – Teacher will review Power Consumption Systems and watch video.

Supplemental Activity – (18:00 minutes) Students will watch energy sources in the U.S. and discuss the video.

Break – 10 Minutes (Site Administrator will work with teachers on breaks)

Teacher Lesson Review – 5 minutes
Slide 15
Teacher will facilitate and guide students as they review lesson.

- The rate of doing work or the rate of energy produced (consumed) is called power.
- $Power,\ P = \frac{\Delta E}{\Delta t}$
- The unit "horsepower" is defined as the energy required to lift a 75 kg mass through a distance of one meter in one second. Its value is equal to 746 W.
- The energy produced/consumed over a time *t* is given as $E = P \times t$.
- The commercial unit of electrical energy is kilowatt-hour (kWh).
- The ever-increasing price of electricity, the global energy demand, the effect of global warming, the depletion of resources, and the shortage of fossil fuels have paved the way for us to save energy.
- Solar panels contain photovoltaic cells which collect energy from the Sun's rays and store it as electrical energy.
- Solar energy is used for heating water, heating rooms, drying agricultural products, and generating electrical energy.
- An electric generator is a device which works on the principle of electromagnetic induction. It converts mechanical energy into electrical energy.
- A clothes iron is a small household electrical appliance, which is used to remove wrinkles on the clothes or fabrics.
- An air conditioner is an electrical appliance which is used to cool a room or a floor.
- Have students review the slides and their notes to prepare for the Post-test

Independent Work – Student Lesson Review*/Post-test (They Do) – 40 minutes. Students will review lesson for essential knowledge/information prior to the daily test.
The students will complete the Lesson Posttest.
The teacher will explain to the students that they will be assessed on the Posttest and will work independently on the Posttest. The teacher will encourage all students to think critically and do their very best on the Posttest. The Posttest will count as the grade for the daily lesson.

Closing/Wrap Up– 5 minutes

The teacher will take a moment to reflect on the lesson of the day. The teacher will repeat selected concepts/content from the Lesson Review. The teacher may use an exit ticket: Ask students: What did you learn? What surprised you? What is unclear?

Total Time: 2 hours 10 minutes

Summer School Lesson Plan

Subject/Grade: Physical Science **Day: 17**

Topic/Lesson Title & Grade Results #: Lesson 7 - Calorimetry

Objective(s): Students will

1. Define heat, heat transfer, and specific heat.
2. Investigate the thermal energy transfer between two liquids of different temperatures when they are mixed together.
3. Investigate and calculate the calories of energy generated by burning food products

Guiding Question(s): What is a closed system? What is heat transfer? What is **thermal equilibrium?**

TN Curriculum Standard(s): Standard(s): PSCI.PS3.2 **Standard Description(s):** Plan and conduct an investigation to provide evidence that thermal energy will move as heat between objects of two different temperatures, resulting in a more uniform energy distribution (temperature) among the objects.

Materials/Resources Needed: Grade Results Online Platform, Grade Results video, paper, pencil or notes in Grade Results

Technology: Computer, Whiteboard, TEAMs meeting (if applicable)

Attendance in PowerSchool – 5 minutes

Lesson Introduction (I Do) – 5 minutes
The teacher will review the standard, introduce the lesson, objectives, lesson vocabulary, and lesson activities.

Key Vocabulary/Terms
Slide 16 – As a whole group, define and discuss the meaning of the vocabulary words

- **Closed system:** A physical system that does not exchange any matter with its surroundings.
- **Conduction:** The process of transfer of heat energy from one point to another through a solid medium.
- **Conservation of energy:** The total energy of an object or a system of objects in motion remains the same.
- **Thermal equilibrium:** The condition in which two or more objects that are in contact exchange no heat energy.
- **Thermal insulator:** A material that does not transmit heat energy.
- **Water equivalent of a substance:** The mass of water that will absorb or lose the same amount of heat as the substance for the same rise or fall in temperature.

Lesson Activities/Supplemental (We Do) – 60 minutes
As a whole group, complete the Practice Activities. The teacher and students will review the lesson content and complete the lesson activities on the following pages.
Slide 1 – Student will state objectives.
Slide 2 – Teacher will introduce the lesson Specific Heat Capacity.
Slide 3 – Teacher will review video on Specific Heat Capacity (3:39) and check for understanding.
Slide 4 – Students will complete activity on Heat and Temperature.
Slide 5 – Teacher will review Specific Heat Capacity and check for understanding.
Slide 6 – Specific Heat Capacity (contd...).
Slide 7 – Watch Video - Specific Heat Capacity – 2 videos (3:53) and (1:04) and check for understanding.

Slide 8 – Students will complete activity on Specific Heat Capacity.
Slide 9 – Teacher will review Calorimetry and check for understanding.
Slide 10 –Watch Video - Calorimetry 2 videos (4:16) and check for understanding.
Slide 11 – Students will complete activity on Calorimetry.
Slide 12 – Students will complete activity on Investigation on Mixing Hot Water and Normal Water.
Slide 13 – Students will complete an Investigation- Measuring the Heat of Combustion of Food.
Supplemental –Watch Video - Energy of Chemical Reactions video (20:36 minutes)

Break – 10 Minutes (Site Administrator will work with teachers on breaks)

Teacher Lesson Review – 5 minutes
Slide 15
Teacher will facilitate and guide students as they review lesson.

- Heat is a form of energy that can be transferred from one object to another.
- The transfer of heat energy from a hotter region to a colder region due to temperature difference is called heat.
- A qualitative measure of how hot or cold an object is called the temperature of the object.
- Increase in the kinetic energy of an object increases its temperature.
- Different objects hold and release heat differently. This property of an object is called the heat capacity or specific heat capacity of the object.
- The heat capacity of a substance is defined as the amount of heat required to raise its temperature by 1 °C or 1 K.
- The quantity of heat required to raise the temperature by 1 °C of a unit mass of a substance (1 kg of a substance) is called the specific heat capacity.
- The unit of specific heat capacity (*c*) is J/kg °C.
- Heat absorbed or released by a substance is represented as: $\Delta Q = mc\Delta T$.
- The science of heat measurement is called calorimetry.
- The law of heat exchange is represented as: **Heat lost = Heat gained**.
- An instrument used to measure the absorption or release of heat in the calorimetric experiments is called a calorimeter.
    - $c = \frac{\left(m_1 + w\right)c'\left(\theta - \theta_1\right)}{m_2(\theta_2 - \theta)}$
- The specific heat capacity of an unknown substance can be determined using the formula:
- Have students review the slides and their notes to prepare for the Post-test

Independent Work – Student Lesson Review*/Post-test (They Do) – 40 minutes. Students will review lesson for essential knowledge/information prior to the daily test.
The students will complete the Lesson Posttest.
The teacher will explain to the students that they will be assessed on the Posttest and will work independently on the Posttest. The teacher will encourage all students to think critically and do their very best on the Posttest. The Posttest will count as the grade for the daily lesson.

Closing/Wrap Up– 5 minutes
The teacher will take a moment to reflect on the lesson of the day. The teacher will repeat selected concepts/content from the Lesson Review. The teacher may use an exit ticket: Ask students: What did you learn? What surprised you? What is unclear?

Total Time: 2 hours 10 minutes

Summer School Lesson Plan

Subject/Grade: Physical Science **Day: 18**

Topic/Lesson Title & Grade Results #: Lesson 8 - Propagation of Waves in Different Media

Objective(s): Students will

1. Describe the characteristics and nature of sound waves.
2. Create a relationship between amplitude, frequency, wavelength, and velocity of sound waves.
3. Differentiate the traveling speed of sound waves in different media.
4. Describe seismic waves.
5. Differentiate the body waves and surface waves.

Guiding Question(s): What are the different types of waves? What is the difference between body waves and surface waves?

TN Curriculum Standard(s): Standard(s): PSCI.PS4.1, PSCI.PS4.2, PSCI.PS4.3. Standard Description(s): Use scientific reasoning to compare and contrast the properties of transverse and longitudinal waves and give examples of each type. Design/conduct an investigation and interpret gathered data to explain how mechanical waves transmit energy through a medium. Develop and use mathematical models to represent the properties of waves including frequency, amplitude, wavelength, and speed.

Materials/Resources Needed: Grade Results Online Platform, Grade Results video, paper, pencil or notes in Grade Results

Technology: Computer, Whiteboard, TEAMs meeting (if applicable)

Attendance in PowerSchool – 5 minutes

Lesson Introduction (I Do) – 5 minutes
The teacher will review the standard, introduce the lesson, objectives, lesson vocabulary, and lesson activities.

Key Vocabulary/Terms
Slide 23 – As a whole group, define and discuss the meaning of the vocabulary words

- **Body waves:** Seismic waves that travel through the Earth's mantle.
- **Bulk modulus:** The ratio of change in pressure, acting on a volume, to the fractional change in volume. It tells how hard the medium is to compress.
- **Bulk strain:** A small change in the volume of a solid.
- **Compressions:** High-pressure regions of a sound wave.
- **Energy:** Capacity of a physical system to perform work.
- **Elasticity:** Tendency of solid materials to return to their original shape after being deformed.
- **Electromagnetic wave:** Wave that travels through a vacuum, transporting energy from one location to another.
- **Longitudinal waves:** Particles moving back and forth parallel to the direction of the wave motion.
- **Mechanical wave:** Wave that travels through a medium, transporting energy from one location to another.
- **Medium**: Material through which a sound wave travels (Solid, liquid, or gas).

- **Pressure:** Force applied perpendicular to the surface of an object per unit area over which that force is distributed.
- **Rarefactions**: Low-pressure regions of a sound wave.
- **Seismic waves:** Waves of energy that travel through Earth's crust as a result of an earthquake, an explosion, or a volcano eruption.
- **Seismograph:** An instrument that measures and records the details of seismic waves.
- **Surface waves:** Seismic waves that pass either through or along the surface of Earth without penetrating deeper.
- **Threshold intensity:** The minimum intensity of sound that can be heard.
- **Transverse wave:** Particles moving up and down perpendicular to the direction of the wave motion.
- **Wavelength**: The distance between consecutive compressions or rarefactions of a wave.
- **Young's modulus:** The ratio of stress acting on a substance to the strain produced.

Lesson Activities/Supplemental (We Do) – 60 minutes
As a whole group, complete the Practice Activities. The teacher and students will review the lesson content and complete the lesson activities on the following pages.
Slide 1 - Student will state objectives.
Slide 2 – Teacher will introduce the lesson and discuss Waves.
Slide 3 – Teacher will review Classification of Waves.
Slide 4 – Watch Video - Waves (3:40).
Slide 5 – Teacher will review Examples of Wave Generation and check for understanding.
Slide 6 – Teacher will review Sound Waves and check for understanding.
Slide 7 – Watch Video - Nature of Sound Waves (3:51).
Slide 8 – Students will complete activity on Sound Waves (drag and drop)
Slide 9 – Teacher will review Amplitude, Frequency, Wavelength, and Velocity of a Sound Wave.
Slide 10 – Watch 3 Videos - Relation Between Amplitude, Frequency, Wavelength, and Velocity of a Sound Wave – (14:22) (3:22) (3:47) and check for understanding.
Slide 11 – Teacher will review Pressure and Intensity of Sound Waves and check for understanding.
Slide 12 – Teacher will review Relation Between Amplitude, Frequency, Wavelength, and Velocity of a Sound Wave (contd...).
Slide 13 – Teacher will review Elastic Property of Materials.
Slide 14 – Students will review problems and complete activity on Speed of Sound in Different Media.
Slide 15 – Students will review example problems and complete activity on Volumetric Stress.
Slide 16 – Students will complete activity on Stress and Strain (drag and drop activity).
Slide 17 – Teacher will review examples of Seismic Waves and check for understanding.
Slide 18 – Watch Video - Seismic Waves.
Slide 19 – Students will complete activity on Surface Waves.
Slide 20 – Students will complete activity on Waves (drag and drop activity)
Slide 21 – Students will complete activity on Wrap-up!

Supplemental Activity – (13:02 minutes) Students will watch video on nature of waves and discuss the video.

Break – 10 Minutes (Site Administrator will work with teachers on breaks)

Teacher Lesson Review – 5 minutes
Slide 22
Teacher will facilitate and guide students as they review lesson.
- A wave is a disturbance that travels through a medium from one location to another.

- In wave propagation, particles in the medium do not transfer; only the energy of the disturbances moves along.
- The material through which a wave travels (solid, liquid, or gas) is called the medium of wave propagation.
- There are three types of waves: mechanical waves, electromagnetic waves, and matter waves. Mechanical waves require a medium to travel through or propagate. Electromagnetic waves do not require a medium to travel through.
- Electrons and particles produce matter waves.
- Mechanical waves are of three different types: transverse waves, longitudinal waves, and surface waves.
- A transverse wave causes the medium to move perpendicular to the direction of the wave.
- A longitudinal wave causes the medium to move parallel to the direction of the wave.
- Surface waves are both transverse and longitudinal waves mixed in one medium.
- A sound is a longitudinal mechanical wave.
- High-pressure regions of a sound wave are called compressions.
- Low-pressure regions of a sound wave are called rarefactions.
- The amplitude of a sound wave is the height of the compression or depth of the rarefaction from its position of equilibrium, measured in decibels.
- The portion of a wave between two compressions or two rarefactions is called a wave cycle.
- Period (*T*) is the time taken to complete one wave cycle.
- A wavelength (λ) can also be defined as the horizontal distance between wave cycles, measured in meters.
- Frequency (*f*) is the number of wave cycles that are completed in one second or pass by a point, measured in Hz.
- Frequency and period are related by the relationship: $f = \frac{1}{T}$ and $T = \frac{1}{f}$
- The speed at which a compression propagates through a medium is the wave speed (velocity). It is different from the speed of the movement of particles of the medium.
- $\mathbf{Velocity} = \frac{\text{distance}}{\text{time}} \mathbf{or} v = f\lambda$
- Sound level, or a degree of loudness of sound, is measured in decibels (dB), and is given by:
- $\beta = \mathbf{10}\log\left(\frac{I}{I_0}\right)\left(in\ decibels\right)$
- The increasing order of sound's speed in different media: Solid > Liquid > Gas.
- The speed of sound depends upon the type and state of the medium. The speed is affected by the medium's elasticity and inertia.
- In gases, the speed *v* of the sound is given by the formula:
- $v = \left(\frac{B}{\rho}\right)^{\frac{1}{2}} = \left(\frac{\gamma^{\rho}}{\rho}\right)^{\frac{1}{2}} = \left(\frac{\gamma kT}{M}\right)$
- In liquids, the speed of the sound is given by the formula:
- $v = \left(\frac{B}{\rho}\right)^{\frac{1}{2}}$
- In solids, the speed of the sound is given by the formula:
- $v = \left(\frac{Y}{\rho}\right)^{\frac{1}{2}}$
- There are two different types of seismic waves produced by an earthquake: body waves and surface waves.

- Body waves are seismic waves that travel through the earth. P-waves and S-waves are the two types of body waves.
- Surface waves are the seismic waves that pass through the surface of the earth, and the layers near the surface, without penetrating deeper. Rayleigh waves and Love waves are the two types of surface wave.
- Have students review the slides and their notes to prepare for the Post-test

Independent Work – Student Lesson Review*/Post-test (They Do) – 40 minutes. Students will review lesson for essential knowledge/information prior to the daily test.
The students will complete the Lesson Posttest.
The teacher will explain to the students that they will be assessed on the Posttest and will work independently on the Posttest. The teacher will encourage all students to think critically and do their very best on the Posttest. The Posttest will count as the grade for the daily lesson.

Closing/Wrap Up– 5 minutes
The teacher will take a moment to reflect on the lesson of the day. The teacher will repeat selected concepts/content from the Lesson Review. The teacher may use an exit ticket: Ask students: What did you learn? What surprised you? What is unclear?

Total Time: 2 hours 10 minutes

Summer School Lesson Plan

Subject/Grade: Physical Science **Day: 19**

Topic/Lesson Title & Grade Results #: Lesson 9 - Electromagnetic Spectrum

Objective(s): Students will

1. Define electromagnetic radiation, electromagnetic waves, and the electromagnetic spectrum.
2. Classify electromagnetic waves according to their energy and wavelength in the electromagnetic spectrum.
3. Calculate the energy of an electromagnetic wave.
4. Identify the presence of different types of electromagnetic waves in our routine life.

Guiding Question(s): What is the electromagnetic spectrum?

TN Curriculum Standard(s): Standard(s): PSCI.PS4.4. **Standard Description(s):** Describe and communicate the similarities and differences across the electromagnetic spectrum. Research methods and devices used to measure these characteristics.

Materials/Resources Needed: Grade Results Online Platform, Grade Results video, paper, pencil or notes in Grade Results

Technology: Computer, Whiteboard, TEAMs meeting (if applicable)

Attendance in PowerSchool – 5 minutes

Lesson Introduction (I Do) – 5 minutes
The teacher will review the standard, introduce the lesson, objectives, lesson vocabulary, and lesson activities.

Key Vocabulary/Terms
Slide 13 – As a whole group, define and discuss the meaning of the vocabulary words

- **Alpha rays:** Radiation consisting of fast-moving, positively-charged particles (a helium nucleus) emitted during the radioactive decay of an element.
- **Antenna:** An electrical device which converts the electric current into radio waves and *vice versa*.
- **Atom:** Smallest sub-microscopic particle of an element, which still possesses all properties of the element.
- **Beta rays:** Radiation consisting of fast-moving, negatively-charged particles (electrons/positrons), emitted during the radioactive decay of an element.
- **Binding energy:** Energy that holds an atom's nucleons together in the nucleus. In other words, it is the energy required to split the nucleus of an atom.
- **Black body:** A hypothetical object that would absorb electromagnetic radiation falling on it, reflect none, and re-emit radiation at all wavelengths.
- **Electromagnetic radiation:** Radiation consisting of photons produced by changes in the energy of accelerating electrons.
- **Electromagnetic spectrum:** The arrangement of electromagnetic radiation according to the energy (frequency) or wavelength.

- **Electromagnetic waves:** Energy that propagates as a transverse wave, consisting of oscillating electric and magnetic fields perpendicular to each other, generated by accelerating charged particles.
- **Electron:** A negatively-charged component of an atom, outside its nucleus.
- **Gamma rays:** Neutral rays coming out of radioactive element with no mass (photons).
- **Nucleus:** A dense core of the atom consisting of particles which are either neutral or positively charged.
- **Radioactive decay:** The spontaneous disintegration in which an unstable nucleus eventually decays by emitting particles and transforms into another nucleus.
- **Ramification:** Consequence of an event or a subdivision of a complex structure.
- **Stable atom:** An atom that has enough binding energy to hold its nucleus together permanently.
- **Transmutation:** The process where a radioactive atom tries to become stable by releasing neutrons and transforms into an atom of a new element.
- **Unstable atom:** Atom without enough binding energy to hold the nucleus together.
- **Visible light:** The range of electromagnetic spectrum that humans can see.
- **X-rays:** High-energy electromagnetic wave or radiation with wavelengths between 0.01 nm and 10 nm, approximately.

Lesson Activities/Supplemental (We Do) – 60 minutes
As a whole group, complete the Practice Activities. The teacher and students will review the lesson content and complete the lesson activities on the following pages.
Slide 1 - Student will state objectives.
Slide 2 – Teacher will introduce the lesson and discuss the electromagnetic radiation, waves & spectrum.
Slide 3 – Teacher will review Electromagnetic Radiation (EMR), and students will answer question.
Slide 4 – Teacher will review Nature of Electromagnetic Radiation and check for understanding.
Slide 5 – Teacher will review Dual Nature of Electromagnetic Waves and check for understanding.
Slide 6 – Teacher will review Energy of Electromagnetic Waves and check for understanding.
Slide 7 – Teacher will review Energy of Electromagnetic Waves (contd...)
Slide 8 – Students will complete activity on Atomic Structure.
Slide 9 – Teacher will review Electromagnetic Waves and check for understanding.
Slide 10 – Teacher will review Electromagnetic Waves (contd...)
Slide 10 – Students will complete activity I (14:28 minutes) and answer 5 questions.
Slide 11 – Students will complete activity II (Drag and Drop activity).
Supplemental – N/A

Break – 10 Minutes (Site Administrator will work with teachers on breaks)

Teacher Lesson Review – 5 minutes
Slide 12
Teacher will facilitate and guide students as they review lesson.
- The Sun is the main source of electromagnetic radiation on Earth. Electromagnetic radiation is emitted as electromagnetic waves.
- The solar spectrum consists of infrared radiation, visible light, and ultraviolet radiation. Gamma rays, X-rays, microwaves, and radio waves are emitted from other sources.
- "The electromagnetic spectrum" refers to all different types of radiations in a group placed in a hierarchy according to wavelength and energy.
- Have students review the slides and their notes to prepare for the Post-test

Independent Work – Student Lesson Review*/Post-test (They Do) – 40 minutes. Students will review lesson for essential knowledge/information prior to the daily test.

The students will complete the Lesson Posttest.
The teacher will explain to the students that they will be assessed on the Posttest and will work independently on the Posttest. The teacher will encourage all students to think critically and do their very best on the Posttest. The Posttest will count as the grade for the daily lesson.

Closing/Wrap Up– 5 minutes
The teacher will take a moment to reflect on the lesson of the day. The teacher will repeat selected concepts/content from the Lesson Review. The teacher may use an exit ticket: Ask students: What did you learn? What surprised you? What is unclear?

Total Time: 2 hours 10 minutes

Summer School Lesson Plan

Subject/Grade: Physical Science **Day: 20**

Topic/Lesson Title & Grade Results #: Final Post-Test Review & Post-Test

Objective(s):

- Students will review lessons to prepare for final Post-Test.
- Final Post-Test will open. All students must complete the final Post-Test

Materials/Resources Needed: Grade Results Online Platform, Grade Results video, paper, pencil or notes in Grade Results

Technology: Computer, Whiteboard, TEAMs meeting (if applicable)

Lesson Introduction (I Do):
Identify the purpose of the course
Connect the course to missing or future coursework and Post-test

Lesson Activities/Supplemental (We Do) – 30-60 minutes

Lesson Activities and Review (We Do):
Check Grade Results and have students review activities/lesson they have not completed or need assistance with. Hold an open Q&A for students to ask questions regarding the activities/lessons they are reviewing.

Independent Work – Posttest (They Do):
Students will review and complete any incomplete/missed/failed coursework.

Closing/Wrap Up: