



## **Science 8**

### **Semester A Summary:**

Science 8A uses multiple media sources to foster scientific inquiry and spark curiosity as the student explores topics of the physical sciences. Throughout this course, the student will discover ways that scientists use data, models, and technology to gather and apply information. The student will learn about atomic composition and the properties of matter, then distinguish between chemical and physical changes in matter and investigate how thermal energy transfer affects particle motion in matter. They will also examine the relationship between potential and kinetic energy as they explore how mass and speed affect energy transfer. Finally, this course presents several principles of physics as the student explores the relationship between force and motion while learning about Newton's Laws of Motion.

### **Semester A Outline**

#### **1. Science 8 Course Overview**

1. Science 8 Course Overview

#### **2. Properties of Matter**

1. Properties of Matter Introduction
2. Thermal Energy
  - In this section, you will develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.
3. A Mystery Investigation
  - In this section, you will describe the evidence of an investigation that supports a claim that pure substances can be distinguished based on characteristic properties.
4. Mass, Weight, and Density
  - In this section, you will explain the relationship between, mass and weight.
  - In this section, you will explain the relationship between mass and weight.
5. Separating Mixtures
  - In this section, you will explain that mixtures of substances can be separated based on their chemical and physical properties.
6. Synthetic Materials, Natural Resources
  - In this section, you will explain how human-made materials come from natural resources.
7. The Impact of Synthetic Materials
  - In this section, you will support a claim that creation and use of human-made materials impact society in positive and negative ways.
8. The Impact of Synthetic Materials Discussion
9. Properties of Matter Apply
10. Properties of Matter Review
11. Properties of Matter Unit Test

### 3. Matter Interactions

1. Matter Interactions Introduction
2. The Composition of Atoms
  - In this section, you will develop models to describe the composition of atoms.
  - In this section, you will examine models of an atom and evaluate the limitations of the models.
3. Molecules and Structures
  - In this section, you will develop models to describe the atomic composition of simple molecules and structures formed by the bonding of the same molecules.
4. The Periodic Table
  - In this section, you will describe patterns in the properties of similarly grouped elements by asking questions about locations of common elements on the periodic table.
  - In this section, you will explain how the physical properties of elements and their reactivity have been used to produce the Periodic Table of elements.
5. Physical vs. Chemical Change
  - In this section, you will distinguish between chemical and physical change.
6. Chemical Reactions
  - In this section, you will describe the law of conservation of mass in chemical reactions.
  - In this section, you will describe what takes place during chemical reactions at the atom level.
  - In this section, you will describe what takes place during chemical reactions using chemical equations.
7. Matter Interactions Portfolio 1
  - In this portfolio activity, you will analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.
  - In this section, you will develop an investigation question to demonstrate that properties of substances are changed in a chemical reaction.
  - In this section, you will conduct the investigation, collecting appropriate data.
8. Matter Interactions Portfolio 2
  - In this section, you will conduct the investigation, collecting appropriate data.
  - In this section, you will analyze data from the investigation.
  - In this section, you will analyze data from the investigation.
9. Matter Interactions Portfolio 3
  - In this section, you will evaluate the investigation.
10. Law of Conservation of Matter
  - In this section, you will explain the law of conservation of matter.
11. Conservation in Chemical Reactions
  - In this section, you will describe how the total number of atoms does not change in a chemical reaction.
  - In this section, you will describe the effect on the total number of atoms in a chemical reaction.
  - In this section, you will develop a model to describe how the total number of atoms does not change in a chemical reaction.
12. Matter Interactions Apply
13. Matter Interactions Review
14. Matter Interactions Unit Test

### 4. Energy of Motion

1. Energy of Motion Introduction
2. Kinetic and Potential Energy
  - In this section, you will describe the relationship between the energy an object possesses when it is in motion and its stored energy because of its position relative to Earth.
  - In this section, you will describe the relationship between the energy an object possesses when it is in motion and its stored energy because of its position relative to Earth.
3. Factors that Affect Kinetic Energy
  - In this section, you will record how changing the mass and the speed of an object affect the energy it possesses because it is in motion.
  - In this section, you will record how changing the mass and the speed of an object affect the energy it possesses because it is in motion.
4. Predicting Changes in Kinetic Energy
  - In this section, you will predict how changing the mass or speed of an object will change the energy the object possesses because it is in motion.
5. Potential Energy of a System
  - In this section, you will design a visual or 3-D model to represent how the positioning of multiple objects in a system can influence the system's stored energy.
6. Energy Transfer and Kinetic Energy
  - In this section, you will construct an explanation, by using a real-life example, of how energy transfer can be shown through changes in energy that an object possesses because of its motion.
7. Using Potential and Kinetic Energy
  - In this section, you will analyze how humans use technology to store energy resulting from an object's position relative to Earth and/or use energy resulting from an object's motion.
8. Energy of Motion Apply
9. Energy of Motion Review
10. Energy of Motion Unit Test

## 5. **Thermal Energy**

1. Thermal Energy Introduction
2. Kinetic and Thermal Energy
  - In this section, you will explain the relationship between the energy resulting from motion and heat energy.
3. Matter and Temperature
  - In this section, you will identify and describe properties of matter in relation to energy resulting from motion and heat energy as measured by temperature.
4. Energy Transfer and Temperature
  - In this section, you will analyze data collected about how the transfer of energy resulting from motion affects the matter in relation to the temperature of a sample of the matter.
  - In this section, you will analyze data collected about how the transfer of energy resulting from motion affects the matter in relation to the temperature of a sample of the matter.
  - In this section, you will analyze data collected about how the transfer of energy resulting from motion affects the matter in relation to the temperature of a sample of the matter.
5. Kinetic Energy Transfer

- In this section, you will analyze data from an investigation about how the energy that results from motion affects matter in relation to the temperature of the sample.
  - In this section, you will explain data from an investigation about how the energy that results from motion affects matter in relation to the temperature of the sample.
  - In this section, you will develop a conclusions from an investigation about how the energy that results from motion affects matter in relation to the temperature of the sample.
6. Energy Transfer Device Portfolio 1
- In this portfolio activity, you will apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.
  - In this section, you will develop questions and discuss in groups about how to maximize or minimize heat energy transfer.
  - In this section, you will design a device to minimize or maximize heat energy transfer.
  - In this section, you will define the standards and limitations that must be taken into account in the design solution.
7. Energy Transfer Device Portfolio 2
- In this section, you will create a device to minimize or maximize heat energy transfer.
  - In this section, you will test a device to minimize or maximize heat energy transfer.
  - In this section, you will evaluate the effectiveness of a device to minimize or maximize heat energy transfer by using test data.
8. Energy Transfer Device Portfolio 3
- In this section, you will develop a model to generate data for repeated testing and modification of a proposed object, tool, or process such that the best design can be achieved.
  - In this section, you will improve the design of the device to minimize or maximize heat energy transfer.
9. Thermal Energy Transfer
- In this section, you will explain with the aid of a model how heat energy is transferred within fluids from hotter regions into colder ones.
  - In this section, you will explain with the aid of a model how heat energy is transferred from hotter regions or objects and into colder ones, by objects directly touching each other or across a gap.
10. Thermal Energy Apply
11. Thermal Energy Review
12. Thermal Energy Unit Test

## 6. Force and Motion

1. Force and Motion Introduction
2. Position, Distance, and Displacement
  - In this section, you will distinguish between various terms that describe how an object's position changes and how fast its position and direction change.
  - In this section, you will describe the motion of an object by graphically showing the relationship between time and position.
3. Magnitude and Direction of Force
  - In this section, you will explain that forces have an extent and direction; they affect the motion of objects.

4. Forces that Change Motion
  - In this section, you will describe forces that change an object's motion
5. Force and Motion Portfolio 1
  - In this portfolio, you will investigate how a change in an object's motion depends on the sum of the forces on the object and the mass of the object.
  - In this section, you will explain how the sum of the forces on an object and its mass influence an object's motion.
6. Force and Motion Portfolio 2
  - In this section, you will explain how the sum of the forces on an object and its mass influence an object's motion.
  - In this section, you will analyze data from an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the object's mass.
  - In this section, you will evaluate information to develop conclusions to support a claim that the change in an object's motion depends on the sum of the forces on the object and the object's mass.
7. Force and Motion Portfolio 3
  - In this section, you will present your findings from your investigation to model Newton's First Law of Motion.
8. Newton's First Law
  - In this section, you will explain Newton's First Law of Motion supported by real-life examples as evidence.
9. Newton's Second Law
  - In this section, you will explain Newton's Second Law of Motion supported by real-life examples as evidence.
10. Newton's Third Law
  - In this section, you will explain how Newton's Third Law applies to problems involving the motion of two colliding objects.
11. Collision Forces
  - In this section, you will design a solution to a real-life collision problem that considers equal and opposite forces in order to calculate how much force is exerted by the first object on the second, and by the second object on the first, during the collision.
  - In this section, you will design a solution to a real-life collision problem that considers equal and opposite forces in order to calculate how much force is exerted by the first object on the second, and by the second object on the first, during the collision.
12. Force and Motion Apply
  - In this section, you will draw a force diagram that shows the forces and the direction of the forces involved if an off-road vehicle driver tries to drive in reverse while another person pulls the vehicle in the opposite direction.
13. Force and Motion Review
14. Force and Motion Unit Test

## **Semester B Summary:**

Science 8B uses multiple media sources to foster scientific inquiry and spark curiosity as the student studies elements of the physical sciences. Throughout this course, the student will discover ways that scientists use data, models, and technology to gather and apply information.

This course begins with an investigation of how different types of waves transmit light, sound, and other forms of energy both in the presence and absence of matter. The student will learn about the unseen forces of gravity, magnetism, and electricity as they determine factors that affect the strength of these forces. Finally, the student will explore the role of design in machines as they investigate the connection between force input and work output.

## **Semester B Outline**

### **1. Science 8 Course Overview**

1. Science 8 Course Overview

### **2. Waves**

1. Waves Introduction
2. Properties of Waves
  - In this section, you will identify and describe the properties of a wave.
3. Different Types of Waves
  - In this section, you will recognize that different kinds of waves have common characteristics and unique properties.
  - In this section, you will learn about the different uses for energy associated with waves.
4. Modeling Waves
  - In this section, you will create a mathematical representation of a wave by using data from demonstrations.
5. Light and Sound Waves
  - In this section, you will obtain, evaluate, and communicate information to support the claim that light waves behave differently than sound waves.
  - In this section, you will explain how the rate of vibration, material through which vibrations travel, sound, and hearing are related
  - In this section, you will explain how visible light, the electromagnetic spectrum, and sight are related
6. Reflection of Waves
  - In this section, you will describe examples of how waves are reflected by various materials.
7. Technologies for Information Transfer
  - In this section, you will describe examples of how waves are absorbed by various materials.
8. How are Waves Transmitted?
  - In this section, you will describe examples of how waves are transmitted through various materials.
9. Energy in Waves
  - In this section, you will show the relationship between energy and different frequencies of light and similar waves by using data.
  - In this section, you will learn how waves transfer energy in the form of longitudinal and transverse waves.
10. Interaction of Waves
  - In this section, you will use a visual, written, or 3-D example of how waves can interact with a specific material in a real-life example.
11. Digitalized Signals
  - In this section, you will support a claim about how converting and transmitting information as one type of signal is more reliable than doing so as another.

- In this section, you will learn about how energy associated with waves can be used to send and receive information

12. Digitalized Signals Discussion

13. Waves Apply

14. Waves Review

15. Waves Unit Test

### 3. **Force and Work**

1. Force and Work Introduction

2. Force and Work Relationships

- In this section, you will scientifically describe the relationship between force and work.

3. Pulleys and Inclined Planes

- In this section, you will describe pulleys and inclined planes, including specialized inclined planes like the screw.
- In this section, you will develop diagrams to show how the design of pulleys and inclined planes helps transfer mechanical energy by reducing the amount of force required to do work.

4. Levers

- In this section, you will identify and describe the different classes of levers.
- In this section, you will plan and conduct controlled scientific investigations to provide evidence for how levers help transfer mechanical energy by reducing the amount of force required to do work.
- In this section, you will analyze data from investigations to provide evidence for how levers help transfer mechanical energy by reducing the amount of force required to do work.

5. Efficiency of Machines

- In this section, you will explain how the efficiency of a machine can be improved by reducing the effort or the amount of energy transferred to the surrounding environment as it moves an object.
- In this section, you will design solutions that improve the efficiency of a machine by reducing the effort or the amount of energy transferred to the surrounding environment as it moves an object.
- In this section, you will describe methods for testing solutions that improve the efficiency of a machine by reducing the effort or the amount of energy transferred to the surrounding environment as it moves an object.

6. Force and Work Apply

7. Force and Work Review

8. Force and Work Unit Test

### 4. **Gravity**

1. Gravity Introduction

2. Gravitational Force

- In this section, you will define and describe gravitational force and explain the gravitational relationship between Earth and objects on Earth.

3. Gravitational Attraction and Mass

- In this section, you will explain the relationship between gravitational attraction and mass.

4. Investigating Gravity

- In this section, you will plan an investigation to provide evidence that the effect of gravity on earthly objects is the same regardless of the mass of those objects.

- In this section, you will use the terms *hypothesis*, *theory*, and *law* correctly, making sure you understand the differences among them.
5. Analyzing Gravitational Data
    - In this section, you will analyze data from an investigation to provide evidence that the acceleration due to gravity of objects near Earth is the same, regardless of the mass of those objects.
  6. Gravity and Air Resistance
    - In this section, you will explain the relationship between air resistance and gravity on a falling object.
  7. Gravity Apply
  8. Gravity Review
  9. Gravity Unit Test
- 5. Non-Contact Forces**
1. Non-Contact Forces Introduction
  2. Strength of Electrical Forces
    - In this section, you will ask questions about data to determine the factors that affect the strength of electric forces.
  3. Conductors and Insulators
    - In this section, you will describe the similarities and differences of conductors and insulation material at the atomic level.
  4. Electrical Energy Properties
    - In this section, you will analyze data to describe the properties of electrical energy.
  5. Electric Circuits
    - In this section, you will explain how energy is conserved as it is transferred and transformed in electrical circuits.
    - In this section, you will explain how energy is conserved as it is transferred and transformed in electrical circuits.
    - In this section, you will describe energy changes from one type to another.
  6. Strength of Magnetic Forces
    - In this section, you will analyze data to determine the factors that affect the strength of magnetic forces.
  7. Non-Contact Forces Portfolio 1
    - In this portfolio activity, you will design an investigation to explore magnetic fields, analyze data from the investigation, draw conclusions, and then apply what you have learned.
    - In this section, you will collect observations and generate questions about the strength of electric fields from a demonstration.
    - In this section, you will collect observations and generate questions about the strength of magnetic fields.
  8. Non-Contact Forces Portfolio 2
    - In this section, you will identify fields that exist between two objects that are not in contact.
    - In this section, you will perform multiple trials of an investigation to collect data about fields between two non-touching objects.
    - In this section, you will analyze data from an investigation to explore magnetic fields and draw conclusions.
    - In this section, you will learn how magnetic fields cause the magnetic effects of certain materials.
  9. Non-Contact Forces Portfolio 3



- In this section, you will evaluate an experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.

#### 10. Electromagnetism in Use

- In this section, you will explain how electric currents and magnetic fields are related to each other in generators, simple electrical motors, and magnets created by the flow of the electric current.
- In this section, you will explain how electric currents and magnetic fields are used in electromagnets, bells, speakers and microphones, motors and dynamos, and maglev trains.

#### 11. Non-Contact Forces Apply

#### 12. Non-Contact Forces Review

#### 13. Non-Contact Forces Unit Test

### 6. **The Design World**

#### 1. The Design World Introduction

#### 2. Design Technology

- In this section, you will explain the suitability of materials for use in technological design based on their response to heat. These responses to heat include conduction, expansion, and contraction.
- In this section, you will explain the suitability of materials, conductors, and insulators for use in technological design based on their response to electrical energy.
- In this section, you will analyze data from investigations about the effectiveness of different materials to increase or reduce electrical energy transfer.

#### 3. Physics and Chemistry in Design

- In this section, you will explain the use of physics principles in important technologies used in construction.
- In this section, you will explain the use of chemistry principles in important technologies used for the creation of materials.

#### 4. Transportation Design

- In this section, you will identify and describe how transportation systems are designed to move people and goods using a variety of vehicles and devices.
- In this section, you will identify and describe structural and propulsion systems that are part of a transportation vehicle.
- In this section, you will identify and describe guidance, suspension, and control systems that are part of a transportation vehicle.

#### 5. The Design World Apply

#### 6. The Design World Review

#### 7. The Design World Unit Test