

Middle School Grade 8 Science Tutorials offer targeted instruction, practice, and review designed to help students develop scientific literacy, deepen conceptual understanding, and apply scientific practices. Students explore concepts such as waves, the relationship between force and motion, Earth's place in the universe, Earth's systems and resources, Earth's history, and the diversity of life.

Students engage with the content in an interactive, feedback-rich environment as they progress through standards-aligned modules. By continually honing their ability to apply knowledge in real-world scenarios, students build the depth of knowledge and higher-order skills required to demonstrate their mastery when put to the test.

In each module, the Learn It and Try It make complex ideas accessible to students as they explore the nature of science through focused content, interactive mini investigations, multi-modal representations, and personalized feedback. The Review It offers a high-impact summary of key concepts and relates those concepts to students' lives. The Test It assesses students' mastery of the module's concepts, providing granular performance data to students and teachers after each attempt. To help students focus on the content most relevant to them, unit-level pretests and posttests can quickly identify where students are strong and where they're still learning.

These Tutorials are built to the Next Generation Science Standards for middle school science.

1. NATURE OF SCIENCE

• WHAT IS SCIENCE?

- **8.E.4B.5** Obtain and communicate information to describe how data from technologies (including telescopes, spectrosopes, satellites, space probes) provide information about objects in the solar system and the universe.
- **8.S.1A.4.2** support hypotheses, explanations, claims, or designs.
- **8.S.1A.1.1** generate hypotheses for scientific investigations,
- **8.S.1A.3.1** formulate scientific questions and testable hypotheses,
- **8.S.1A.1.2** refine models, explanations, or designs, or

• TYPES OF INVESTIGATIONS

- **8.S.1A.3.3** select and use appropriate tools or instruments to collect qualitative and quantitative data, and
- **8.S.1A.1.1** generate hypotheses for scientific investigations,
- **8.S.1A.3.1** formulate scientific questions and testable hypotheses,
- **8.S.1A.4.1** reveal patterns and construct meaning or
- **8.S.1A.6.3** predictions based on observations and measurements, or
- **8.S.1A.1.3** extend the results of investigations or challenge claims.
- **8.S.1A.3.2** identify materials, procedures, and variables,
- **8.S.1A.4.2** support hypotheses, explanations, claims, or designs.

• USING MODELS

- **8.S.1A.2.1** understand or represent phenomena, processes, and relationships,
- **8.S.1A.6.1** primary or secondary scientific evidence and models,
- **8.S.1A.6.3** predictions based on observations and measurements, or
- **8.S.1A.1.2** refine models, explanations, or designs, or

2. MEASUREMENT AND DATA

• TOOLS AND MEASUREMENT

- **8.S.1A.3.3** select and use appropriate tools or instruments to collect qualitative and quantitative data, and
- **8.S.1A.3.4** record and represent data in an appropriate form. Use appropriate safety procedures.
- **8.S.1A.5.2** collect and analyze data,
- **8.S.1A.5.1** use and manipulate appropriate metric units,

- **DISPLAYING AND INTERPRETING DATA**

- **8.S.1A.3.4** record and represent data in an appropriate form. Use appropriate safety procedures.
- **8.S.1A.5.2** collect and analyze data,
- **8.S.1A.2.1** understand or represent phenomena, processes, and relationships,
- **8.S.1A.5.3** express relationships between variables for models and investigations, or
- **8.S.1A.4.1** reveal patterns and construct meaning or
- **8.S.1A.5.4** use grade-level appropriate statistics to analyze data.
- **8.S.1A.8.1** answer questions,

3. WAVES

- **MECHANICAL WAVES AND SOUND**

- **8.P.3A.1** Construct explanations of the relationship between matter and energy based on the characteristics of mechanical and light waves.
- **8.S.1A.5.3** express relationships between variables for models and investigations, or
- **8.S.1A.5.2** collect and analyze data,
- **8.S.1A.6.1** primary or secondary scientific evidence and models,
- **8.S.1A.6.4** data communicated in graphs, tables, or diagrams.
- **8.P.3A.2** Develop and use models to exemplify the basic properties of waves (including frequency, amplitude, wavelength, and speed).
- **8.P.3A.4** Analyze and interpret data to describe the behavior of mechanical waves as they intersect.

- **ELECTROMAGNETIC WAVES**

- **8.P.3A.1** Construct explanations of the relationship between matter and energy based on the characteristics of mechanical and light waves.
- **8.P.3A.2** Develop and use models to exemplify the basic properties of waves (including frequency, amplitude, wavelength, and speed).
- **8.S.1A.5.3** express relationships between variables for models and investigations, or
- **8.S.1A.5.2** collect and analyze data,
- **8.S.1A.4.1** reveal patterns and construct meaning or
- **8.S.1A.6.1** primary or secondary scientific evidence and models,
- **8.P.3A.5** Construct explanations for how humans see color as a result of the transmission, absorption, and reflection of light waves by various materials.
- **8.S.1A.6.4** data communicated in graphs, tables, or diagrams.

4. APPLICATIONS OF WAVES

- **WAVES AND MATTER**

- **8.P.3A.1** Construct explanations of the relationship between matter and energy based on the characteristics of mechanical and light waves.
- **8.P.3A.3** Analyze and interpret data to describe the behavior of waves (including refraction, reflection, transmission, and absorption) as they interact with various materials.
- **8.P.3A.5** Construct explanations for how humans see color as a result of the transmission, absorption, and reflection of light waves by various materials.
- **8.S.1A.6.4** data communicated in graphs, tables, or diagrams.
- **8.S.1A.5.2** collect and analyze data,
- **8.S.1A.4.2** support hypotheses, explanations, claims, or designs.
- **8.S.1A.6.1** primary or secondary scientific evidence and models,

- **8.S.1A.7** Construct and analyze scientific arguments to support claims, explanations, or designs using evidence from observations, data, or informational texts.
- **8.S.1A.8.2** explain or describe phenomena,

- **WAVES AND TECHNOLOGY**

- **8.S.1B.1.1** ask questions to identify problems or needs,
- **8.P.3A.6** Obtain and communicate information about how various instruments are used to extend human senses by transmitting and detecting waves (such as radio, television, cell phones, and wireless computer networks) to exemplify how technological advancements and designs meet human needs.
- **8.S.1A.8.3** develop models,
- **8.S.1B.1.3** generate and communicate ideas for possible devices or solutions,
- **8.E.4B.5** Obtain and communicate information to describe how data from technologies (including telescopes, spectrometers, satellites, space probes) provide information about objects in the solar system and the universe.
- **8.S.1A.4.2** support hypotheses, explanations, claims, or designs.
- **8.S.1A.8.1** answer questions,

5. FORCE AND MOTION

- **DESCRIBING FORCES**

- **8.P.2A.4** Analyze and interpret data to support claims that for every force exerted on an object there is an equal force exerted in the opposite direction (Newton's Third Law of Motion).
- **8.S.1A.5.2** collect and analyze data,
- **8.S.1A.5.1** use and manipulate appropriate metric units,
- **8.S.1A.4.1** reveal patterns and construct meaning or
- **8.S.1A.6.1** primary or secondary scientific evidence and models,
- **8.S.1A.6.4** data communicated in graphs, tables, or diagrams.
- **8.S.1A.7** Construct and analyze scientific arguments to support claims, explanations, or designs using evidence from observations, data, or informational texts.
- **8.S.1A.8.1** answer questions,
- **8.S.1A.8.3** develop models,
- **8.P.2A.1** Plan and conduct controlled scientific investigations to test how varying the amount of force or mass of an object affects the motion (speed and direction), shape, or orientation of an object.
- **8.P.2A.2** Develop and use models to compare and predict the resulting effect of balanced and unbalanced forces on an object's motion in terms of magnitude and direction.
- **8.P.2A.5** Analyze and interpret data to describe and predict the effects of forces (including gravitational and friction) on the speed and direction of an object.

- **DESCRIBING MOTION**

- **8.S.1A.6.4** data communicated in graphs, tables, or diagrams.
- **8.S.1A.7** Construct and analyze scientific arguments to support claims, explanations, or designs using evidence from observations, data, or informational texts.
- **8.P.2A.6** Use mathematical and computational thinking to generate graphs that represent the motion of an object's position and speed as a function of time.
- **8.S.1A.5.2** collect and analyze data,
- **8.S.1A.5.1** use and manipulate appropriate metric units,
- **8.P.2A.7** Use mathematical and computational thinking to describe the relationship between the speed and velocity (including positive and negative expression of direction) of an object in determining average speed ($v=d/t$).

6. FORCES IN ACTION

- **EFFECTS OF FORCES**

- **8.P.2A.2** Develop and use models to compare and predict the resulting effect of balanced and unbalanced forces on an object's motion in terms of magnitude and direction.
- **8.P.2A.3** Construct explanations for the relationship between the mass of an object and the concept of inertia (Newton's First

Law of Motion).

- **8.S.1A.4.2** support hypotheses, explanations, claims, or designs.
- **8.S.1A.6.1** primary or secondary scientific evidence and models,
- **8.S.1A.6.3** predictions based on observations and measurements, or
- **8.S.1A.7** Construct and analyze scientific arguments to support claims, explanations, or designs using evidence from observations, data, or informational texts.
- **8.S.1A.8.1** answer questions,
- **8.P.2A.1** Plan and conduct controlled scientific investigations to test how varying the amount of force or mass of an object affects the motion (speed and direction), shape, or orientation of an object.
- **8.P.2A.5** Analyze and interpret data to describe and predict the effects of forces (including gravitational and friction) on the speed and direction of an object.
- **8.S.1A.5.2** collect and analyze data,
- **8.S.1A.5.1** use and manipulate appropriate metric units,
- **8.S.1A.4.1** reveal patterns and construct meaning or
- **8.S.1A.6.4** data communicated in graphs, tables, or diagrams.

● **GRAVITATIONAL FORCE**

- **8.S.1A.5.3** express relationships between variables for models and investigations, or
- **8.S.1A.5.2** collect and analyze data,
- **8.S.1A.5.1** use and manipulate appropriate metric units,
- **8.S.1A.4.1** reveal patterns and construct meaning or
- **8.S.1A.6.1** primary or secondary scientific evidence and models,
- **8.S.1A.6.3** predictions based on observations and measurements, or
- **8.S.1A.6.4** data communicated in graphs, tables, or diagrams.
- **8.S.1A.7** Construct and analyze scientific arguments to support claims, explanations, or designs using evidence from observations, data, or informational texts.
- **8.S.1A.8.1** answer questions,
- **8.P.2A.5** Analyze and interpret data to describe and predict the effects of forces (including gravitational and friction) on the speed and direction of an object.

7. FORCES IN THE SOLAR SYSTEM

● **SUN-EARTH-MOON SYSTEM**

- **8.E.4B.2** Construct explanations for how gravity affects the motion of objects in the solar system and tides on Earth.
- **8.E.4B.4** Develop and use models to explain how motions within the Sun-Earth-Moon system cause Earth phenomena (including day and year, moon phases, solar and lunar eclipses, and tides).
- **8.S.1A.8.2** explain or describe phenomena,
- **8.E.4B.3** Develop and use models to explain how seasons, caused by the tilt of Earth's axis as it orbits the Sun, affects the length of the day and the amount of heating on Earth's surface.

● **OUR SOLAR SYSTEM**

- **8.S.1A.5.3** express relationships between variables for models and investigations, or
- **8.S.1A.8.4** evaluate hypotheses, explanations, claims, or designs or
- **8.P.2A.5** Analyze and interpret data to describe and predict the effects of forces (including gravitational and friction) on the speed and direction of an object.
- **8.E.4B.2** Construct explanations for how gravity affects the motion of objects in the solar system and tides on Earth.
- **8.E.4B.1** Obtain and communicate information to model and compare the characteristics and movements of objects in the solar system (including planets, moons, asteroids, comets, and meteors).

8. EXPLORING THE UNIVERSE

● **THE UNIVERSE**

- **8.E.4A.1** Obtain and communicate information to model the position of the Sun in the universe, the shapes and composition

of galaxies, and the measurement unit needed to identify star and galaxy locations.

- **8.S.1A.4.2** support hypotheses, explanations, claims, or designs.
- **8.E.4A.2** Construct and analyze scientific arguments to support claims that the universe began with a period of extreme and rapid expansion using evidence from the composition of stars and gases and the motion of galaxies in the universe.

● THE SUN AND OTHER STARS

- **8.E.4B.6** Analyze and interpret data from the surface features of the Sun (including photosphere, corona, sunspots, prominences, and solar flares) to predict how these features may affect Earth.
- **8.S.1A.5.3** express relationships between variables for models and investigations, or
- **8.P.2A.5** Analyze and interpret data to describe and predict the effects of forces (including gravitational and friction) on the speed and direction of an object.

● SPACE EXPLORATION

- **8.P.3A.6** Obtain and communicate information about how various instruments are used to extend human senses by transmitting and detecting waves (such as radio, television, cell phones, and wireless computer networks) to exemplify how technological advancements and designs meet human needs.
- **8.E.4A.1** Obtain and communicate information to model the position of the Sun in the universe, the shapes and composition of galaxies, and the measurement unit needed to identify star and galaxy locations.
- **8.E.4B.5** Obtain and communicate information to describe how data from technologies (including telescopes, spectrosopes, satellites, space probes) provide information about objects in the solar system and the universe.
- **8.S.1A.1.2** refine models, explanations, or designs, or
- **8.S.1A.2.2** test devices or solutions, or
- **8.S.1A.4.2** support hypotheses, explanations, claims, or designs.
- **8.S.1A.7** Construct and analyze scientific arguments to support claims, explanations, or designs using evidence from observations, data, or informational texts.
- **8.S.1A.8.4** evaluate hypotheses, explanations, claims, or designs or
- **8.S.1B.1.1** ask questions to identify problems or needs,
- **8.S.1B.1.2** ask questions about the criteria and constraints of the device or solutions,

9. EXPLORING PLANET EARTH

● MODELS OF EARTH

- **8.S.1A.6.4** data communicated in graphs, tables, or diagrams.
- **8.S.1A.8.1** answer questions,
- **8.S.1A.8.2** explain or describe phenomena,
- **8.E.4B.4** Develop and use models to explain how motions within the Sun-Earth-Moon system cause Earth phenomena (including day and year, moon phases, solar and lunar eclipses, and tides).

● EARTH'S STRUCTURE AND CYCLES

- **8.E.5A.3** Obtain and communicate information about the relative position, density, and composition of Earth's layers to describe the crust, mantle, and core.

● THE ROCK CYCLE

- **8.S.1A.8.1** answer questions,
- **8.E.5A.2** Use the rock cycle model to describe the relationship between the processes and forces that create igneous, sedimentary, and metamorphic rocks.
- **8.S.1A.5.2** collect and analyze data,

10. EARTH'S PLATES

● PLATE TECTONICS

- **8.E.5A.4.1** the motion of lithospheric plates,
- **8.E.5A.4.2** the geologic activities at plate boundaries, and

- **8.E.5A.4.3** *the changes in landform areas over geologic time.*
- **8.E.5B.1** *Analyze and interpret data to describe patterns in the location of volcanoes and earthquakes related to tectonic plate boundaries, interactions, and hot spots.*
- **8.E.5B.2** *Construct explanations of how forces inside Earth result in earthquakes and volcanoes.*
- **8.E.5A.5.1** *the distribution of fossils on different continents,*
- **8.E.5A.5.2** *the occurrence of earthquakes, and*
- **8.E.5A.5.3** *continental and ocean floor features (including mountains, volcanoes, faults and trenches).*

- **DEFORMING EARTH'S CRUST**

- **8.E.5A.4.2** *the geologic activities at plate boundaries, and*
- **8.E.5A.4.3** *the changes in landform areas over geologic time.*

- **EARTHQUAKES AND VOLCANOES**

- **8.E.5A.5.2** *the occurrence of earthquakes, and*
- **8.E.5B.2** *Construct explanations of how forces inside Earth result in earthquakes and volcanoes.*
- **8.S.1A.5.2** *collect and analyze data,*
- **8.E.5A.5.3** *continental and ocean floor features (including mountains, volcanoes, faults and trenches).*
- **8.E.5B.1** *Analyze and interpret data to describe patterns in the location of volcanoes and earthquakes related to tectonic plate boundaries, interactions, and hot spots.*
- **8.E.5B.3** *Define problems that may be caused by a catastrophic event resulting from plate movements and design possible devices or solutions to minimize the effects of that event on Earth's surface and/or human structures.*

11. EARTH'S RESOURCES

- **NATURAL RESOURCES**

- **8.E.5C.1** *Obtain and communicate information regarding the physical and chemical properties of minerals, ores, and fossil fuels to describe their importance as Earth resources.*
- **8.S.1A.8.1** *answer questions,*

- **MINERALS**

- **8.E.5C.1** *Obtain and communicate information regarding the physical and chemical properties of minerals, ores, and fossil fuels to describe their importance as Earth resources.*

12. OUR CHANGING PLANET

- **CLIMATE**

- **8.S.1A.8.3** *develop models,*
- **8.E.4B.3** *Develop and use models to explain how seasons, caused by the tilt of Earth's axis as it orbits the Sun, affects the length of the day and the amount of heating on Earth's surface.*
- **8.S.1A.4.2** *support hypotheses, explanations, claims, or designs.*
- **8.S.1A.7** *Construct and analyze scientific arguments to support claims, explanations, or designs using evidence from observations, data, or informational texts.*
- **8.S.1A.8.1** *answer questions,*
- **8.S.1A.8.2** *explain or describe phenomena,*
- **8.S.1A.8.4** *evaluate hypotheses, explanations, claims, or designs or*
- **8.E.6A.3** *Construct explanations from evidence for how catastrophic events (including volcanic activities, earthquakes, climatic changes, and the impact of an asteroid/comet) may have affected the conditions on Earth and the diversity of its life forms.*
- **8.E.6B.2** *Obtain and communicate information to support claims that natural and human-made factors can contribute to the extinction of species.*

- **WEATHERING AND EROSION**

- **8.S.1A.8.1** answer questions,
- **8.S.1A.8.2** explain or describe phenomena,
- **8.E.5A.1** Develop and use models to explain how the processes of weathering, erosion, and deposition change surface features in the environment.

- **GEOLOGIC TIME**

- **8.S.1A.5.2** collect and analyze data,
- **8.E.6A.2** Analyze and interpret data from index fossil records and the ordering of rock layers to infer the relative age of rocks and fossils.
- **8.E.6A.3** Construct explanations from evidence for how catastrophic events (including volcanic activities, earthquakes, climatic changes, and the impact of an asteroid/comet) may have affected the conditions on Earth and the diversity of its life forms.
- **8.E.6A.1** Develop and use models to organize Earth's history (including era, period, and epoch) according to the geologic time scale using evidence from rock layers.
- **8.S.1A.4.2** support hypotheses, explanations, claims, or designs.
- **8.S.1A.8.1** answer questions,
- **8.E.5A.5.1** the distribution of fossils on different continents,
- **8.E.6A.4.1** the diversity of life that has been present on Earth,
- **8.E.6A.4.2** relationships between past and existing life forms, and
- **8.E.6A.4.3** environmental changes that have occurred during Earth's history.
- **8.E.6A.5** Construct explanations for why most individual organisms, as well as some entire taxonomic groups of organisms, that lived in the past were never fossilized.
- **8.E.6B.2** Obtain and communicate information to support claims that natural and human-made factors can contribute to the extinction of species.

13. OUR CHANGING BIOSPHERE

- **THEORY OF EVOLUTION**

- **8.E.6A.4.1** the diversity of life that has been present on Earth,
- **8.E.6A.4.3** environmental changes that have occurred during Earth's history.
- **8.E.6A.3** Construct explanations from evidence for how catastrophic events (including volcanic activities, earthquakes, climatic changes, and the impact of an asteroid/comet) may have affected the conditions on Earth and the diversity of its life forms.
- **8.E.6A.5** Construct explanations for why most individual organisms, as well as some entire taxonomic groups of organisms, that lived in the past were never fossilized.
- **8.E.6B.2** Obtain and communicate information to support claims that natural and human-made factors can contribute to the extinction of species.
- **8.S.1A.4.2** support hypotheses, explanations, claims, or designs.
- **8.S.1A.8.4** evaluate hypotheses, explanations, claims, or designs or
- **8.E.6A.4.2** relationships between past and existing life forms, and

- **NATURAL SELECTION**

- **8.E.6B.1** Construct explanations for how biological adaptations and genetic variations of traits in a population enhance the probability of survival in a particular environment.
- **8.S.1A.8.2** explain or describe phenomena,