

# IUSD SCIENCE STANDARDS - GRADE 7

## Cell Biology

1. All organisms are composed of cells - the fundamental unit of life. Most organisms are single cells; other organisms, including humans, are multicellular. As a basis for understanding this concept, students know:
  - a. cells function similarly in all living organisms.
  - b. parts of cells are called organelles, each of which has a specific function.**
  - c. reproduction is a characteristic of all living organisms and is essential for the continuation of every species. Organisms reproduce sexually and/or asexually.**
  - d. cells divide to increase their numbers through a process of mitosis, which results in two daughter cells with identical sets of chromosomes.**
  - e. as multicellular organisms develop, their cells differentiate.

## Structure and Function in Living Things

2. The anatomy and physiology of plants and animals illustrate the complementary nature of structure and function. As a basis for understanding this concept, students know:
  - a. plants and animals have levels of organization for structure and function, including cells, tissues, organs, organ systems, and the whole organism. The failure of any part can affect the entire system.
  - b. organisms have systems for digestion, respiration, reproduction, circulation, excretion, brain and nerve function, movement, control and coordination, and for protection from disease. These systems interact with one another.
  - c. the structure and processes by which flowering plants generate pollen and ovules, seeds and fruit.**
  - d. all living things follow the patterns of various cycles and behavior is affected by these cycles: life cycles, extinction, respiration, transpiration, photosynthesis, and reproduction (mitosis). As multicellular organisms develop, their cells differentiate.**

## Genetics

3. A typical cell of any organism contains genetic instructions that specify its traits. These traits may be modified by environmental influences. As a basis for understanding this concept, students know:
  - a. DNA is the genetic material of living organisms, and is located in the chromosomes of each cell.**
  - b. asexual reproduction produces offspring that are genetically identical to the single parent. Sexual reproduction produces offspring that inherit half of their genes from each parent.
  - c. an inherited trait can be determined by one or more genes.**
  - d. plant and animal cells contain many thousands of different genes, and typically have two copies of every gene. The two copies (or alleles) of the gene may or may not be identical, and one may be dominant in determining the phenotype while the other is recessive.

## IUSD SCIENCE STANDARDS - GRADE 7 (continued)

### Evolution

4. Biological evolution accounts for the diversity of species developed through gradual processes over many generations. As a basis for understanding this concept, students know:
  - a. both genetic variation and environmental factors are causes of evolution and diversity of organisms.
  - b. the reasoning used by Darwin in making his conclusion that natural selection is the mechanism for evolution.**
  - c. how independent lines of evidence from geology, fossils and comparative anatomy provide a basis for the theory of evolution.
  - d. how to construct a simple branching diagram to classify living groups of organisms by shared derived characteristics, and expand the diagram to include fossil organisms.
  - e. extinction of a species occurs when the environment changes and the adaptive characteristics of a species are insufficient for its survival.**

### Earth and Life History

5. Over geologic time, tectonic forces have been responsible for the major geographic features of the Earth's crust. As the basis for understanding this concept, students know:
  - a. Earth processes today are similar to those that occurred in the past and slow geologic processes have large cumulative effects over long periods of time.
  - b. the history of life on Earth has been disrupted by major catastrophic events, such as major volcanic eruptions or the impact of an asteroid.
  - c. the rock cycle includes the formation of new sediment, rocks and soil. Rocks are often found in layers with the oldest generally on the bottom.
  - d. rocks are classified by how they are formed within the rock cycle and by their mineral contents.
  - e. there are various ways to measure the age of rocks and fossils and this allows us to place geologic events in a time sequence called the geologic time scale.**
  - f. how movements of the Earth's continental and oceanic plates through time, with associated changes in climate and geographical connections, have affected the past and present distribution of organisms.

## IUSD SCIENCE STANDARDS - GRADE 7 (continued)

### Wave Energy: Sound, Light and Earthquakes

6. Waves, including sound and seismic waves, waves on water, and light waves, have energy and can transfer energy when they interact with matter. As a basis for understanding this concept, students know:
- energy waves (sound, light, and earthquake) have properties (frequency, wavelength, and amplitude).**
  - there are three types of mechanical waves: transverse, longitudinal, and surface.**
  - different forms of electromagnetic radiation are distinguished from each other by their wavelengths.**
  - light is a way that energy is transferred from the source that emits the light (transmission) to the object or substance that absorbs it, refracts it or reflects it.
  - the angle of reflection of a light beam is equal to the angle of incidence.
  - modern technological devices are examples of ways we utilize sound and light energy.

### Atmosphere

7. Energy from the sun heats the Earth unevenly, causing air movements resulting in changing weather patterns. As a basis for understanding this concept, students know:
- uneven heating of the Earth causes air movements (convection currents).
  - the influence of the ocean on weather, and the role of the water cycle in weather.
  - differences in pressure, heat, air movement, and humid-ity result in changes in weather, which can be severe.
  - how to use weather maps and weather forecasts to predict local weather and that prediction depends on many changing variables.
  - the pressure of our atmosphere varies with altitude.
  - the sun is the major source of energy for phenomena on the Earth's surface, powering winds, ocean currents, and the water cycle.**
  - the Earth's atmosphere has not always been the same as it is today.

### Science Process Skills (Investigation and Experimentation)

8. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept, and to address the content the other three strands, students should develop their own questions and perform investigations. Students will:
- a. **Select and use appropriate tools and technology (including calculators, computers, balances, spring scales, and microscopes) to perform tests, collect data, and display data.**
  - b. Utilize a variety of print and electronic resources (including the Internet) to collect information as evidence as part of a research project.
  - c. **Communicate the logical connection among hypothesis, science concepts, tests conducted, data collected, and conclusions drawn from scientific evidence.**
  - d. Construct scale models, maps and appropriately labeled diagrams to communicate scientific knowledge (e.g., motion of Earth's plates and cell structure).
  - e. **Communicate the steps and results from an investigation in written reports and verbal presentations.**

# IUSD SCIENCE STANDARDS - GRADE 8

## Motion

1. The velocity of an object is the rate of change of its position. As a basis for understanding this concept, students know:
  - a. position is defined relative to some choice of standard reference point and a set of reference directions.
  - b. average speed is the total distance traveled divided by the total time elapsed. The speed of an object along the path traveled can vary.
  - c. how to solve problems involving speed, velocity, acceleration and momentum.**
  - d. to describe the velocity of an object one must specify both direction and speed. Changes in velocity can be changes in speed or direction or both.
  - e. how to interpret graphs of distance versus time, and speed versus time for motion in a single direction. (Acceleration)**

## Forces

2. All objects exert a force. Balanced and unbalanced forces account for the behavior of objects. As a basis for understanding this concept, students know:
  - a. a force has both direction and magnitude.
  - b. when an object is subject to two or more forces at once, the effect is the cumulative effect of all of the forces.
  - c. when the forces on an object are balanced, the motion of the object does not change, and when the forces on the object are unbalanced the object will change its motion (that is, it will speed up, slow down, or change direction).
  - d. an object at rest will remain at rest and an object in motion will remain in motion at constant velocity unless acted upon by an unbalanced force: Newton's First Law.**
  - e. force, mass, and acceleration are related: Newton's Second Law.**
  - f. for every action, there is an equal and opposite reaction: Newton's Third Law.**
  - g. how to identify forces acting on an object. Examples include gravity, compression, tension, and friction.
  - h. all objects in the universe attract one another by the force of gravity.

## IUSD SCIENCE STANDARDS - GRADE 8 (continued)

### Energy

3. Energy is a property of many substances and is associated with heat, light, electricity, mechanical motion, sound, nuclei, and the nature of a chemical. Energy can be converted from one form to another. As a basis for understanding this concept, students know:
- energy is the ability to do work or exert a force through a distance.**
  - heat energy is caused by the motion of molecules and can be converted into other forms of energy.**
  - heat and temperature are not the same thing but are related to one another.
  - when fuel is consumed, most of the energy released becomes heat energy due to friction.
  - heat moves in predictable ways, flowing from warmer objects to cooler ones, until both reach the same temperature.
  - heat energy can be transferred from one place to another by processes of conduction, convection, and radiation.

### Structure of Matter

4. All matter is comprised of one or more of over 100 elements. Elements have distinct properties and atomic structure. As a basis for understanding this concept, students know:
- the structure of the atom and how it is composed of protons, neutrons, and electrons.**
  - compounds are formed by combining two or more different elements. Compounds have properties that are different from the constituent elements.**
  - atoms and molecules form solids by building up repeating patterns such as the crystal structure of NaCl or long chain polymers.
  - the states (solid, liquid, gas) of matter depend on molecular motion. In solids, the atoms are closely locked in position and can only vibrate, in liquids the atoms and molecules are more loosely connected and collide with and move past one another, while in gases the atoms or molecules are free to move independently.
  - substances can be classified by their properties including melting temperature, density, hardness, heat, and electrical conductivity.
  - matter can be classified as elements, compounds, mixtures, and solutions.**

### Periodic Table

5. The organization of the Periodic Table is based on the properties of the elements and reflects the structure of atoms. As a basis for understanding this concept, students know:
- how to identify regions corresponding to metals, nonmetals, and inert gases.**
  - the number of protons in the nucleus, which is called the atomic number, defines elements. Different isotopes of an element have a different number of neutrons in the nucleus.**
  - how to use the Periodic Table to identify elements in simple compounds.**

## IUSD SCIENCE STANDARDS - GRADE 8 (continued)

### Reactions

6. Chemical reactions are processes in which atoms are rearranged into different combinations of molecules. As a basis for understanding this concept, students know:
- reactant atoms and molecules interact to form products with different chemical properties.**
  - the idea of atoms explains the conservation of matter: in chemical reactions the number of atoms stays the same no matter how they are arranged, so their total mass stays the same.**
  - chemical reactions usually liberate heat or absorb heat. These reactions can be classified as endothermic or exothermic.
  - a phase change results from a transfer of energy. Physical processes include freezing and boiling, in which a material changes form with no chemical reaction.
  - how to determine whether a solution is acidic, basic, or neutral.**

### Chemistry of Living Systems

7. Principles of chemistry underlie the functioning of biological systems. As a basis for understanding this concept, students know:
- carbon, because of its ability to combine in many ways with itself and other elements, has a central role in the chemistry of living organisms.
  - living organisms are made of molecules largely consisting of carbon, hydrogen, nitrogen, oxygen, phosphorus and sulfur.**
  - living organisms have many different kinds of molecules including small ones such as water and salt, and very large ones such as carbohydrates, fats, proteins, and DNA.

### Density and Buoyancy

8. All objects experience a buoyant force when immersed in a fluid. As a basis for understanding this concept, students know:
- weight, mass, volume and density can be measured and the relationships among them calculated.
  - density is mass per unit volume.**
  - how to calculate the density of substances (regular and irregular solids, and liquids) from measurements of mass and volume.
  - the buoyant force on an object in a fluid is an upward force equal to the weight of the fluid it has displaced.**
  - how to predict whether an object will float or sink.

## IUSD SCIENCE STANDARDS - GRADE 8 (continued)

### Earth In The Solar System (Earth Science)

9. The structure and composition of the universe can be learned from the study of solar system, stars and galaxies, and their evolution. As a basis for understanding this concept, students know:
- galaxies are clusters of billions of stars, and may have different shapes.
  - the sun is one of many stars in our own Milky Way galaxy. Stars may differ in size, temperature, and color.**
  - units of measurement of distance between the sun, stars, and Earth including astronomical units and light years.
  - stars are the source of light for all bright objects in outer space. The moon and planets shine by reflected sunlight, not by their own light. Stars can be arranged in patterns called constellations.
  - the appearance, general composition, relative position and size, and motion of objects in the solar system, including planets, planetary satellites, comets, and asteroids.**
  - every object in the universe is in motion (rotation, revolution, expansion)
  - space exploration has helped us to acquire knowledge of the Earth and has benefited mankind.**

### Science Process Skills (Investigation and Experimentation)

10. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept, and to address the content the other three strands, students should develop their own questions and perform investigations. Students will:
- plan and conduct a scientific investigation to test a hypothesis.
  - evaluate the accuracy and reproducibility of data.
  - distinguish between manipulated and responding variables and controlled parameters in an experiment.
  - recognize the slope of the linear graph as the constant in the relationship  $y=kx$  and apply this to interpret graphs constructed from data.
  - construct appropriate graphs from data and develop quantitative statements about the relationships between variables.**
  - apply simple mathematical relationships to determine one quantity given the other two (including speed = distance/time, density = mass/volume, force = pressure x area, volume=area x height).**
  - distinguishes between linear and non-linear relationships on a graph of data.