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Elements and Minerals in Our World and in Our Bodies

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Rationale

My unit will introduce students to an overview of science topics using the elements as a common theme. This unit aims to reinforce the idea that science is constantly being added to and changed, but that the methods and practices are constant. It also aims to show students that we are part of nature and have the same requirements as all other living things. This unit is connected to many of Connecticut's science standards for second graders; it addresses soil makeup and classification, life cycles, and food groups and nutrition.

Most students are unaware of the miraculous nature of their bodies. They know little about the enormous impact nutrition makes on their growing bones and bodies. They do not know how to nourish and care for their bodies with nutrition and exercise. They are also unaware of the theory of evolution and the great similarity between their bodies and many favorite and known animals and that humans are integral in the natural world. Moreover, many are uninterested in, and feel no connection to, the aforementioned topics. I want students to understand that science isn't a belief system - rather it is a way of studying and observing the natural world. My unit aims to provide an overview of science. To provide context for the subjects covered in detail there will be units of: Astronomy, Geology, and Biology (Biology will be broken up into the subunits botany and zoology). The subtopics: the skeleton, nutrition, and evolution will also be included. My curriculum will begin with a brief introduction to the elements. Students will become familiar with the most commonly found elements in our atmosphere and earth and with those in our bodies. Students will learn about planets and the elements of which they are made. The unit will then delve into geology and students will learn about the three different kinds of rocks and the minerals of which they are made. Students will then learn about different types of soil.

The Biology unit will continue with a general introduction to the bones and muscles of the human body. Students will learn how bones and muscles are formed and what minerals and nutrients are needed to keep them healthy. Students will learn about the skeleton and engage in several activities to interest and familiarize them with the human skeleton and bones. Students will have the opportunity to make and put together paper skeleton mobiles and other hands on activities.

The unit will then segue into lessons about nutrition and the benefits of healthy foods and habits- specifically the importance of exercise and calcium, vitamin D, and protein for bone development. Students will learn about foods that contain the vitamins and minerals and protein that make bones strong and flexible. It will

also delve into the ability of our bodies to make vitamin D from sunlight. A brief lesson about sun safety will also be included. Students will learn to read nutrition labels and do an experiment with chicken bones that shows the importance of minerals for bone health (students will put bones in vinegar and discover that as the vinegar leeches the bones' minerals they become rubbery and soft).

Between licks of a lollipop, one of my students recently said, "Sugar is my one true love." After learning where food comes from, students will also study what "real food" looks like. Many of my students know nothing of unprocessed food. The food we get in school breakfast and lunch is processed. Breakfast consists of sugary cereal or muffin with a carton of juice and a carton of skim milk. There is little to no protein in their breakfast. And while my students do love the fresh whole fruit that is served they abhor the "yucky salad bar." In truth it's not yucky at all. There's usually an assortment of fresh (though not organic) vegetables. There is often baby spinach, carrots, string beans, bean sprouts, and other fresh vegetables. But I've seen children leave with nothing but a plate of pickles. Just that the pickles are next to garbonzo beans is enough for one of my students to associate pickles with fresh nutritious vegetables. He was shocked I told him that 6 pickles was too many and explained that they are not fresh, they're called pickles because they've been pickled - which is a process that involves curing vegetables, in this case small cucumbers, with salt and preservatives and that too much salt isn't good for you. Similarly, one of my second graders was similarly taken aback when, at our visit to a local farm, he learned that bacon is from pigs. To summarize, my students have little knowledge of and exposure to healthy food. This is very troubling and helps to explain national health trends. As of June 1, 2012 America Heart Association (AHA) listed this data on its website: one in three children is overweight and obese and one in six is obese. As of 2009, the proportion of children who are overweight or obese is five times higher than it was in 1974. The AHA also advises that overweight adolescents have a 70% chance of becoming overweight adults.

This unit will explain the theory of evolution, to ground and emphasize that humans are part of the natural world though most students think of us as separate. It will capitalize on most students' love of dogs and gorillas and will use several activities and presentations to show the similarities between the human skeleton and that of dogs. It is important to explain that we did not evolve from apes that are existent now; and that, we, and all other life, come from a common ancestor. Scientists have demonstrated this through extensive research with fossils and similarities between species. This unit will also include a brief section about the life cycles of plants and butterflies.

Students will able to make observations and ask questions about physical objects and their environment. They will analyze, critique, and communicate investigations using words and drawings. This unit will also use books to further engage and educate students. There will be at least one fiction and one nonfiction book suggested for each subtopic.

Objectives

The goal of this unit is provide an overview of common elements and minerals in teaching about the planets, the earth, the skeleton, and nutrition. This unit will provide context with which students can relate to their environment. The objectives attained in this unit are aligned with district and state standards.

· Students will compare and contrast the properties that distinguish solids, liquids, and gases and be able to describe differences in the physical properties of solids and liquids.
· Students will be able to explain the importance of soil to plants, animals, and people.
· Students will be able to classify soils by properties such as color, particle size (sand, silt, or clay), or amount of organic material (loam).
· Students will be able to explain that we convert food into the nutrients, building blocks, and energy that we use to live and grow.
· Students will able to describe what are bodies are made of and the nutrients we need to be healthy.
· Students will learn "identify the sources of common foods and to " classify them by their basic food groups.
· Students will be able to evaluate the nutritional value of different foods by analyzing package labels.
· Students will be able to describe a life cycle and explain that of plants and animals.

Research

What is Science?

According to Webster's New Collegiate Dictionary, the definition of science is "knowledge attained through study or practice," or "knowledge covering general truths of the operation of general laws, esp. as obtained and tested through scientific method [and] concerned with the physical world." [11] Science is a systematic method of acquiring and organizing knowledge. Scientists observe and experiment to learn about the natural world. There are many branches of science including, but not limited to: astronomy, geology, biology, botany, and zoology.

Elements

Elements are the building blocks of all things. At present scientists have discovered, or made, 120 different elements. The human body is made up of over 70 different elements. We need these elements widely varying amounts to function but we are mostly composed of oxygen, carbon, hydrogen, nitrogen, calcium and phosphorus. Elements and molecules can be classified into three main groups: solids, liquids, and gases. Solids keep their shape, do not flow, and cannot be easily compressed. Liquids cannot be easily compressed either, but do not keep their shape and take the shape of shape of whatever container they are in. Liquids flow and can be poured. Like liquids, gases do not keep their shape and take the shape of the container they're in.

Gases also flow and can be compressed. These fundamental facts about matter will be included in all topics.

Astronomy

The Sun is the closest of over 200 billion stars in the universe; it is also the largest object in the solar system. It is part of a galaxy called the Milk Way. Galaxies are large group of stars; there are billions of galaxies. The elements that make up the sun are 98% gas (70% Hydrogen, 28% Helium). If you were to stand on the surface of the sun you would fall in. You would also burn up- at its surface the sun is K (5,000 degrees Celsius). [2] It provides the light and heat that allows life on planet Earth.

There are eight plants in our solar system. In relation to their proximity to the sun from closest to farthest, they are: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune. Uranus and Neptune. The inner planets Mercury, Venus and Earth and Mars are like an orange, with a rocky peel and in inner core of iron and nickel. They are dense (heavy) but small. The outer planets are large and made of mostly composed of the element hydrogen. The Earth's atmosphere is composed of light elements called gases. Oxygen (~20.946%) and nitrogen (~78.084%) make up the majority of the earth's atmosphere. [3] .

Mars is the fourth planet from the sun (227.9 million kilometers away). It is the second smallest planet. It is often referred to as the "Red Planet" because its surface is covered in red rocks and dirt. The average temperature on Mars is about 218 Kelvin (-55 degrees Celsius). Its atmosphere is also mostly carbon dioxide (made of the elements carbon and oxygen) and it is unsuitable for life. [4]

The fifth planet from the sun is Jupiter (778.4 million kilometers away). It is the largest planet in our solar system with a diameter of 142,984 kilometers. It is 318 times larger than planet Earth. [5] Jupiter does not have a solid surface, rather its surface is comprised of oxygen and water. Like the sun, if you were to stand on Jupiter's surface you would fall in. Therefore it is known as a gas giant. Jupiter has three rings that are only visible as it moves in front of the sun. The rings are named: Gossamer, Main, and Halo. Jupiter also has 50 moons.

The sixth planet from the sun is Saturn (1.4 billion kilometers away) and is the second largest planet. The temperature on Saturn is 105 Kelvin (minus168 degrees Celsius). Saturn is also a gas giant- its surface is comprised of methane, hydrogen and helium. While Saturn is known for its rings, it also has 53 moons. [6]

Uranus is the seventh planet from the sun (2.87 billion kilometers away) and is the third largest planet in our solar system. Uranus is also a gas giant; its surface is comprised primarily of hydrogen and helium with small amounts of methane and ammonia. [7] Uranus is oft called the "Ice Giant" because of its very cold temperatures. Uranus also has rings made up of dust particles and rocks and it has 27 moons.

Neptune is the furthest planet from the sun sitting 4.5 billion kilometers away and is the fourth largest planet. It is considered one of the coldest place in our solar system with temperatures as low as 55 Kelvin (-218 degrees Celsius). [8] Neptune is the smallest of the "Gas Giants" and like Uranus, its atmosphere contains hydrogen, helium, and methane. Neptune has a giant storm similar to the one found on Jupiter, it is called "The Great Dark Spot" because it is seen as a dark spot on the planet's surface.

Why We Have Day and Night and the Seasons.

The earth rotates on its almost vertical rotational axis. Imagine a rod going straight through the center of the earth and through the bottom. But which way is up and which is down in space? And, what does it mean to be

vertical in space? The article The Earth's Rotation answers this question: "we can think of vertical as straight up and down with respect to the plane in which the Earth orbits the Sun." This article points out that "some objects rotate about a horizontal axis, like a rolling log. Some objects, such as a skater, rotate about a vertical axis." The Earth's axis is tilted over about 23.5° from vertical. This tilt is what gives planet Earth our seasons. During the summer months the Sun's rays hit the Earth at a more direct angle than during the winter and our days are much longer than our nights. This makes the summer warmer than winter. The winter is colder because the days are much shorter and the sun's rays are hitting the earth at an extreme angle. The article suggests that to imagine the earth's rotational axis we "think of the Earth as a spinning top, tipped over to one side." The Earth rotates once around every 24 hours - this rotation gives us night and day. This means we're spinning at around 1,000 miles per hour. [9] But we don't feel it because everything around us, including our atmosphere, is moving at the same speed. The part of the earth that is facing the sun experiences day and the opposite side experiences night. The rotation of the earth and the cycle of night and day and our seasons developed over billions of years. These rhythms produced rhythms in us. Our bodies tell us it is time to sleep when it is dark and to be active when it is light. This makes us diurnal animals. Animals that are active at night and sleep during the day are nocturnal. We need sleep to be healthy because it allows our bodies to rest and repair. Adequate sleep is essential for young children to grow normally. Because our bodies are at rest during sleep the body can devote its energy to growth.

Geology

Geology is the study of "the solid earth, the rocks of which it is composed, and the process by which it evolves. [10] Geology allows us to study the Earth's history, as it provides the "primary evidence for plate tectonics, the evolutionary history of life, and past climates." [11] There are three main types of rocks on earth: sedimentary, igneous, and metamorphic.

Sedimentary rocks form when tiny particles of sand, shells, and pebbles are compressed together. Sedimentary rocks are often soft and make break apart easily Limestone is an example of this rock. Fossils are most often found in sedimentary rock.

Igneous rocks form when molten rock, called magma, from the Earth's mantle cools and hardens into rock. Sometimes this happens beneath the surface of the Earth. Other times it is formed when volcanoes erupt. When lava is at the Earth's surface it is called lava. On the surface of the Earth lava usually cools very quickly and becomes very shiny, almost like glass, when it hardens. Other times gas bubbles from deep within the Earth get trapped in the lava; this leaves tiny holes throughout the rock.

Metamorphic refers to change. Metamorphic rocks form deep below the surface of the Earth. Extremely high heat and pressure melt sedimentary or igneous rock and when it rehardens they've changed in form. These rocks often have shiny crystals, which are formed over time from mineral growth on their surface.

Soil is 45% minerals, 25% water, 25% air, and 5% living and decayed organisms. Soil composition varies. Desert soil is different than rain forest soil. Some soils are good for supporting the weight of tall buildings while others are good for growing plants and vegetables. Soil is often found in layers beneath the surface of the earth that vary in color and texture. If you dig a hole you can see that soil is often in layers that have different colors and textures. [12] Soils can be categorized by physical properties like: color, particle size or the proportion of organic material. Soil particles are classified by texture into three categories: sand, silt, and clay. Sand particles are the largest and are grainy, silt particles are more fine and clay particles are so small that they feel smooth. Most clays are formed from the decomposition of living things. [13]

Biology and Classification of All Living things.

Biology is the study of living things. It includes the study of the "structure, function, growth, origin, evolution, and distribution" of organisms [14] An organism is any living thing. Biology is divided into many branches, including zoology, the study of animals, and botany, the study of plants. Scientists have found over 1.75 million species on Earth and new species are being found every day. [15] Scientists have classified - or put into groups - all these organisms to organize and make sense of this incredible number of organisms.

Living things use the elements, the same ones that are in the sun, planets and the earth, to produce life.

Plants and Animals

Living things are divided into two main groups: animals and plants. Botany is the study of all plants such as trees, grasses, and flowers. The grains, vegetables, and fruits we eat are from plants. Most plants need soil to live and grow. Roots take in water held in the soil as well as the minerals they need to live. Plants use water and minerals from the soil, carbon dioxide from the air, and energy from the sun to make food. This process is called photosynthesis.

Zoology is the "branch of biology that relates to the animal kingdom, including the structure, embryology, evolution, classification, habits, and distribution of all animals, both living and extinct." [16] Humans are animals too and we share characteristics with many other animals.

Seven Characteristics of Life

There are seven characteristics common to all living things. They are: cells, organization, a need for energy, responsiveness, growth, reproduction, and adaptation. Living things are composed of cells. Some organisms only have one cell - these cells contain and do everything needed to live and reproduce. Multicellular organisms have differentiated cells that carry out specific processes. Humans are multicellular organisms. For example we have skin cells, which carry out different processes than muscle cells, which are different from bone cells, etc.

Organization is another characteristic of life. Living things are organized at both the molecular and cellular level. Simple substances are organized into more complex ones-amino acids are organized into proteins. Living things are organized at four levels. A tissue is a group of cells that work together to perform a function . Tissues organize into organs, a group of tissues that work together to perform a specific function. Organs organize into organ systems, which are organs that work in concert to perform a specific function. [17]

All living things must take in energy and use it for maintenance, growth, and reproduction. Animals eat things to take in energy to sustain them, while plants use the sun's energy to make food.

All living things must grow. Organisms grow either by cell division - in which a single cell divides to make more, or by cell enlargement - in which individual cells increase in size. While reproduction is not necessary for an individual organism to live, it is necessary for the survival of its species.

Finally, all living things must adapt to their environment. "Adaptations are traits giving an organism an advantage in a certain environment. [18] Variety is important to the long-term viability of species.

The life cycles of plants vary but many begin as seeds, grow to mature plants, and reproduce. Similarly most

animals begin life as babies, grow to maturity, and reproduce. However, many animal species undergo metamorphosis, including butterflies and frogs. The butterfly begins life as an egg, grows into a caterpillar, forms a chrysalis, transforms into a butterfly, and then reproduces by laying eggs. Frogs lay eggs which grow into tadpoles; tadpoles develop front and back limbs and absorb their tails as they mature into frogs.

Evolution

Charles Darwin is the name that comes to most minds when we think of evolution. Through his extensive travels Darwin observed the incredible variability seen within and between organisms. Darwin also observed very similar species living far apart, each physically adapted to their respective habitat. Darwin focused his studies on the bird species on the Galapagos Islands. While he did not have the ability to see the actual units of heredity (genes) he was able to understand much how they functioned to produce the variations he observed. This extensive research led to his (with Alfred Russel Wallace) Theory of Natural Selection. This theory explains the reasons for and benefits of the variation he observed. The theory states that: there is variation in traits amongst organisms, there is differential reproduction, and there is heredity. Differential reproduction refers to the fact that not all "individuals get to reproduce to their full potential." [19] That is, the more fit organisms survive to reproduce while less fit organisms die out.

Evolution, in this context, is biological change over time in species of organisms. To understand evolution some knowledge of genetics is necessary. Genes are units of heredity. They are composed of deoxyribonucleic acid (DNA), a long string of molecules that store genetic information, which is passed from parent to offspring. The DNA sequence refers to the order of these bases. Genes mutate and sometimes these mutations result in more fit organism. It is these organisms that live to reproduce and populate.

Mammals/Vertebrates

Though most animals look nothing like humans we belong to the group of animals called vertebrates. Vertebrates have backbones and include fish, amphibians, reptiles, birds, and mammals. Although vertebrates have a large and noticeable presence on Earth, they make up only 5% of animal species.

Humans are mammals. There are many different mammals living on Earth and all share these same characteristics: hair, mammary glands, diphyodonty, lower jaw made from one bone, diaphragm, endothermy, four-chambered heart, and three middle ear bones. All mammals have hair, even dolphins, when they are born have bits of fuzzy hair on their skin. All mammals have mammary glands and all but a few give birth to live young. Mammary glands are used to feed their young nutritious milk. Diphyodonty refers to mammals particular pattern of tooth replacement -unlike sharks, which lose and grow teeth continually throughout their lives, most mammals only lose their teeth once and grow a permanent set of teeth. Unlike reptiles and fish, mammals have a single lower jawbone that is attached to the skull. Many animals that are not mammals have a diaphragm, but all mammals have this muscle separating the thoracic cavity from the abdominal cavity. This muscle is used in respiration. Mammals have a unique arrangement of three bones in the middle ear. Only mammals have three inner ear bones: incus, malleus, and stapes, more commonly known as the hammer, anvil, and stirrup. The malleus and incus are bones that were once part of the lower jaw in our mammalian ancestors.

Endothermy refers to the ability to regulate the body's temperature regardless of the temperature of the environment. This characteristic is more commonly referred to as "warm-blooded".

All mammals have a heart made of cardiac muscle. The heart muscle contracts to pump blood throughout the

body's blood vessels. It works to deliver oxygen and nutrients throughout the body and remove waste products. In general, the heart consists of multiple chambers (the number of chambers differs for the various animal groups). Mammals all have a four-chambered heart. The mammalian heart has a left and right atrium and a left and right ventricle. "The atrium receives the blood returning to the heart while the ventricle pumps blood from the heart to the rest of the body." [20]

The human skeleton has similarities to those of many animals. Like the human skeleton, birds, most other mammals, and many reptiles have many of the same bones. Wings of birds, front legs of four-footed mammals and the front legs of most reptiles display the same skeletal pattern as that of human arm, wrist and finger bones. Other similarities exist in vertebral, rib and pelvic cages, and leg and foot structures..

Bones

Most bones begin as cartilage. Cartilage is a strong flexible connective tissue found in not just our ears and noses, but also, between joints,in the trachea and bronchial tubes, and in intervertebral discs. It is made of specialized cells called chondroocytes. These cells produce collagen fibers, which allow for cartilage to be flexible. Bones are made of minerals that make them hard and able to bear weight and impact as well as collagen that makes them slightly flexible and able to withstand tension. But bones are also made of living materials. Bones contain: blood vessels which carry nutrients to the bone, nerves that transmit signals the brain, collagen, and three specialized bone cells: osteoblasts, osteocytes, and osteoclasts. Osteoblasts help to form new bone, a process called osteogenesis. These cells take calcium from the blood and deposit in cartilage. In this way layers of "spongy bone are formed around the original cartilage." [21] Osteocytes carry nutrients and waste to and from blood vessels. Osteoclasts help to remove old bone. These cells remove "dissolved calcium…stored in bone and carry it away to tissues whenever needed". [22]

About half of bone is water, and the rest is a combination of protein and minerals. Bones contain large amount of calcium and phosphorus; these minerals make bones hard and strong. (About 99% of the bodies' calcium and 85% of the bodies' phosphorus is found in bones and teeth.) Bones have an outer layer called the periosteum.. Beneath the periosteum lies the hard calcified part of bones called compact bone. Beneath this hard part of bone is spongy bone. Spongy bone is a "network of tiny pieces of bone called trabeculae …[that join] together to form a mesh somewhat like a honeycomb". This structure and sponginess makes spongy bone it resilient but keeps it from being so heavy that movement is restricted due to weight. Bone marrow is a soft jelly-like material found in the spaces between the trabeculae. There are two kinds of bone marrow: red marrow, which makes red and white blood cells and yellow marrow. "Yellow marrow is mostly fat and found in the central hollow spaces of long bones" like the femur. [23]

Healthy Bones

Young children need to eat foods rich in calcium, vitamin D, and phosphorus to build and maintain healthy bones. Because our bodies are constantly removing, using and replacing calcium it is important to maintain a diet rich in calcium. Dairy products are good sources of calcium but as they are also high in fat, it is best to eat low-fat milk, cheese and yogurt. Calcium can also be found in many dark green leafy vegetables, such as broccoli, kale, collard greens and bok choy, as well as in oily fish and small fish with edible bones like sardines and anchovies. Studies have shown that salt and caffeine leach calcium from bones, so it is best to avoid foods high in salt and restrict caffeine intake. Bones are living tissue and respond to weight-bearing exercise by becoming stronger. Engaging in weight-bearing exercise, such as running and weight-lifting, is beneficial to bone health; this exercise should performed for thirty minutes at least three times a week. This is especially

important for young women to incorporate this routine throughout their lifetimes as they are at greater risk for developing osteoporosis.

Human Skeleton

Babies are born with 300 bones while the typical adult human skeleton consists of 206 bones. [24] So what happens - do bones just disappear as we age? No, babies are born with essentially the same bones as an adult. But baby bones have lots of cartilage that makes them soft and flexible. As babies grow to adulthood this cartilage is replaced with calcium and some of their bones fuse together, accounting for the lower number of bones as an adult.

Bones give our body structure, protect our organs, and allow us to move. There are 28 bones in the human head; the skull consists of cranial, facial and ear bones.

Our shoulders are made of the scapulae (shoulder blades), and the clavicles (collarbones). In our chest there is the sternum (breast bone) and our 24 ribs. The backbone is composed of seven cervical (neck) vertebrae, 12 thoracic vertebrae (between the neck and abdomen), and five lumbar vertebrae (lower back). Each of our arms has (from the shoulder) a humerus, radius, and ulna. Our hands and wrists contain 27 bones including: carpal bones (wrist), metacarpal bones (hands), and phalanges (fingers). Legs are attached to the pelvic cradle with hip joints. Our hipbones are really three bones fused together, the" ilium, ischium, and pubis. Our thigh bone is called the femur, and below that are the patella (knee bone) and the tibia and fibia. Our feet and ankles consist of 26 bones including: tarsal bones (ankle), metatarsal bones (foot) and the phalanges (toes). [25]

Through the study of evolution scientists have found how very similar the human skeleton is to that of other organisms. For example dogs also have basically the same skeletal set up as we do. They have a skull, backbone, and arms with a bone extending from the shoulder and connected with a hinge joint to two smaller bones. This is some of the evidence for the theory that all living things descended from a common ancestor.

Muscles

There are three main types of muscle tissue: skeletal muscle, smooth muscle, and cardiac muscle. Skeletal muscles are the muscles we typically think of. They are the muscles that we use to move around. These muscles are also called voluntary muscles - because we control their movement Skeletal muscles begin as single cells. Over time they assemble into long strands that form muscles. The strands are lined up and covered with membrane to form muscles. When muscles contract, they shorten and the ends of the muscle move closer, pulling the bones closer together.

Smooth muscle is a type of involuntary muscle; we do not consciously control these muscles. Smooth muscle is found in the internal organs and in the walls of the arteries. It helps to move food through the digestive system and control the flow of blood through the arteries. [26] Cardiac muscle is another involuntary muscle found only in the heart. Cardiac muscle must be extremely resistant to fatigue as it works continuously to pump blood around our bodies.

Nutrition

We are a part of nature and have the same requirements as all other living things. What is the body made of? How do we use diet to keep ourselves alive and healthy.

Growing children need a wide variety of foods to get the energy (calories) and nutrients they need to "grow, move, and stay healthy." [27] Foods are classified as grains, fruits, vegetables, dairy, meats and beans, and fats. These foods contain carbohydrates, fats, proteins, and other nutrients to fulfill their nutritional needs. Carbohydrates provide energy for us to move and grow. Breads, pasta, rice and cereal are good sources of carbohydrates. We need protein to build muscle and keep the body working properly. Meat, poultry, fish, beans, eggs, and nuts are high in protein. Fats and oils are also found in nuts, meats, and fish, Fats and oils also provide energy for the body. Fruits and vegetables keep our bodies healthy by providing many vitamins and minerals.

Children are constantly growing and usually active, so they need enough calories to support their growth and activity. The American Heart Association (AHA) nutritional guidelines advise that children four to eight make the following recommendations. Children should take in about 1300 kilocalories per day. They should have 2 cups of milk or other dairy products daily to ensure a sufficient intake of calcium for growing bones. They should eat about 19 grams of protein, in the form of lean meat or beans each day. They should eat at least 1.5 cups of fruit and about 1.25 cups of vegetables each day. They should also eat about 4.5 ounces of whole grains per day. No more than 25% to 35% of all calorie intake should come from fat. While this may seem like a high percentage, it makes sense - children's brains are growing rapidly and brains are about 60% fat. Elizabeth M. Ward MS RD advises to add five to a child's age to figure out how much fiber he or she should get daily. That means most second graders should eat about 12 to 13 grams of fiber each day as well. It should be kept in mind that these recommendations are based on the needs of children with a sedentary lifestyle. "Increased physical activity will require additional calories" and nutrients. [28]

The AHA also recommends children consume a minimum of 600 IU of Vitamin D, 400 mg of vitamin A, 500 mg vitamin C, 800 mg calcium, 500 mg phosphorus, and 800 mg of potassium daily. Like calcium, vitamin D is especially important for bone health. This is because vitamin D helps the body to absorb calcium, without it much of the calcium ingested would not be absorbed in the gut. The body can make its own vitamin D from sunlight. Vitamin D is found in many foods, such as eggs and fatty fishes. But many of these forms contain an inactive form of the vitamin that becomes active only when exposed to ultraviolet light from the sun. (vitamin D)

Keeping bones healthy begins at birth. Because babies' bones are mostly cartilage they need a diet with plenty of calcium for their bones to grown and transition to adult bones. The body needs calcium for other metabolic processes too and if there is not enough ingested, osteoclast will remove it from (and in the process weaken) bone. Low-fat milk and cheeses, dark green vegetables from the cabbage family, like collard and mustard greens, broccoli, and bok choy, and tofu are all good sources of calcium. [28]

Exercise

Children also need exercise to both stay fit and build healthy bones. In addition, physical activity also helps to reduce blood pressure, reduce risk of type 2 Diabetes, and also reduce symptoms of depression, stress, and anxiety. [29] Children need about 60 minutes a day of exercise, most of which should be aerobic. On its website the Center for Disease Control (CDC) recommends that children take part in muscle strengthening activities, like push-ups, at least three days a week. The CDC also recommends bone-strengthening activities- like high-impact activities like jumping rope- at three days a week.

Muscles are made of protein. A diet adequate in protein is essential for growing children, as they must build muscle to support their growing bodies.

The human body is about 60% water. Our bodies lose water through sweat and urine and it is important to balance this loss through appropriate water intake to avoid dehydration. Dehydration causes headaches, tiredness, loss of concentration, and can have long-term negative effects on health. Children should drink at least 2.4 liters of water each day. [29]

Most foods contain a combination of nutrients. We look at the nutrition labels on food packages to learn not only which nutrients the food contains but also the amount of them. Nutrition labels show the number of calories, the amount and type of fat, and the amounts of cholesterol, sodium, fiber, protein, and vitamins and minerals contained in a single serving of the food. Labels also show the percentage that the food contains that we need to each. When reading the nutritional information it is important to be mindful of the amount of servings in a package. It is important to be able to differentiate which ingredients will sustain us and make us healthy and which contribute to ill health and disease.

Sample Lessons

Sample Lesson #1: Elements and States of Matter

Objectives: The student will be able to:

1. Understand that anything that takes up space and has mass (or weighs something) is called matter and that all matter is made of one or more elements- the smallest unit of matter of which there are over 120

Day One :

Teacher will use large period table to explain the concept of elements pointing out the most common elements: carbon, oxygen, nitrogen, etc. Teacher will show examples of different types of matter including liquids like water, solids like ice, and water vapor. In small groups students will as many examples of matter as they can. Then they will share their lists and make poster with examples of matter for the classroom. To set up for Day 2 and 3 lessons, teacher should be sure examples of gases and liquids are listed and prompt students if necessary. Students will leave class able to define an "element" and explain the concept of matter.

Sample Lesson #2: Solids and Liquids

Objective: Students will be able to,

1. Describe the properties of solids and liquids and give examples of each.
2. Understand that some compounds, like water and orange juice, can take the form of solid, liquid, and gas depending on conditions.

Class discussion on the properties of solids and liquids during which they will create a poster sized Venn diagram for solids and liquids. For this lesson multiple examples of both solids and liquids (of varying viscosity) spread out around the room. Students walk around the room grouping the examples into the category of solid or liquid using a worksheet.

Activity: Students will observe a can of frozen orange juice and understand that it is in the form of a solid. Students will then add water and observe the orange juice is now a liquid. Teacher will make paper cup mini-popsicles using the orange juice and present them to students during a class discussion about the properties liquids and solids.

Sample Lesson #3: Liquid to Gas

Objectives: Students will be able to,

1. Describe the properties of gases and name at least two gases.

Teacher will use humidifier provide an example of gas. As water vapor is made teacher will capture the vapor in a one gallon clear plastic bag. Teacher will explain that high heat causes the liquid to change into a gas. Class discussion about different gasses, including water vapor, oxygen, helium.

Sample Lesson #4: The Solar System

Objective: Students will become familiar with the 8 planets, their sizes, and their position relative to the sun.

As a class students will make a model of the solar system using different sized balls. This could be as simple as gathering up 8 different sized balls, or more elaborate in having students construct each planet as its properties are discussed. Teacher will teach about the Earth and what makes it habitable. Then students will each get an orange. Teacher will explain that the Earth's crust can be likened to the orange's peel. And that the earth's liquid core can be likened to the fruit of the orange. Students will peel and eat oranges.

Sample lesson #5: The Skeleton

Objectives: Students will be able to,

1. Describe the function of the skeleton
2. Familiarize themselves with the bones in the human skeleton.

Using a large labeled poster, teacher will introduce the skeleton, it's function, and the bones: skull, humerus, ulna, radius, carpals, spine, ribs, pelvis, femur, hand bones (carpals, metacarpals, and phalanges), fibula, feet bones (tarsals, metatarsals, phalanges). In pairs, students will trace around their partner's body on butcher paper. Teacher will pass out cutouts of the bones in the approximate size of those found in second graders. Students will work together to place the bones in the appropriate place on their butcher paper bodies.

Sample Lesson #6: Food groups and serving sizes.

Objectives: Students will be able to,

1. Describe the food groups and provide examples of food for each.
2. Determine approximate serving sizes for common foods.

Teacher will provide tangible examples to show students serving sizes. For example: half a cup of fruit is about the size of a pool ball, a cup of vegetables or a cup of milk is about the size of a baseball, 2-3 ounces of protein is abut the size of a deck of cards, and an ounce of cheese is about the size of a pair of dice. [30] Four large posters depicting a plate divided into the four food groups according to the amount needed to get each day. Students will work in groups to will tape oak tag cutouts of common foods in the appropriate food group.

Lesson #7: Bones

Objectives: Students will be able to,

1. Discuss the importance of strong bones and the minerals that make bone strong.

Teacher will make a labeled poster showing the different parts of bone including: periosteum. Teacher will explain the importance of healthy bones, bone composition, and that the elements calcium and phosphorus are important for healthy bones.

Students will work in pair observing and describing the properties of a chicken bone - mainly that it's hard and strong. Students will place the bones in vinegar and understand that vinegar dissolves the minerals that make bones hard. Students will predict what may be different about the bones if left in vinegar for 3 days.

Then students will remove the bones from the vinegar and describe the properties of the bone. Students will then revisit their prediction and revise if necessary. Students will understand the importance of calcium and phosphorus for healthy bones.

Lesson #8: Evolution

Objectives: Students will be able to,

1. Describe evolution
2. Share similarities and differences between the human skeleton and that of a dog.

Teacher will prepare diagrams of the human skeleton and the skeleton of a dog and prompt the class to find similarities and differences between the two.

Lesson #9: Characteristics of living things

Objectives: Students will be able to,

· Differentiate between living and nonliving things.
· Describe differences between living and not living things.

Teacher will briefly overview of characteristics of living things and provide examples and none-xamples. Class will create a poster with examples of living and nonliving things. Teacher will go into further detail about the characteristics of living things, going into the most detail with organism's need to acquire materials and energy

End of the year Peabody trip

Objectives: Students will be able to,

1. Seek and record relevant information from museum displays.
2. Ask questions about objects and organisms.

Students will split into groups: Astronomy, Rocks and Minerals, Evolution, Mammals, and Nutrition. Each student will have a clipboard and at least five questions pertaining to their group's subject matter. Students will also generate at least two questions that the display did not answer. Students will research their group's topic in that section of the museum and present what they've learned to the class upon returning to school.

Sample questions:

Rocks and Minerals:

What are sedimentary, igneous, and metamorphic rock?

Where are they found? Give three examples of each.

What kind of rock are diamonds, and how are they made?

Evolution :

What is evolution?

What is the name for a scientist who studies fossils? Paleontologist.

What are fossils? Fossils are the hardened remains of living things from long ago.

What have scientists can scientists learn about animals that lived long ago by studying fossils?

Where to scientists believe that human life started in Africa: The Riff Valley in Africa.

Nutrition:

How many grams of protein should a second grader eat each day?

How many grams of sugar should a second grader eat each day?

What is a calorie?

How many teaspoons of sugar are in a serving of: Coca Cola, iced tea, fruit juice?

How is the body affected if a person is overweight?

How many hours should a second grader spend exercising each day?

Astronomy:

What are the 8 planets in order from the sun?

What is each planet composed of?

Mammals

What is a mammal?

What is a vertebrate? What is an invertebrate?

Name three mammals?

How do you know humans are mammals?

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