

Science Study Guide

Nature of Science:

- **Science Safety** is always first and is the most important part of any hands-on experience. Always follow lab rules and immediately notify the teacher if there is a problem. Safety = teacher
- **Scientific Investigations and Processes:**
 - Asking questions (what, when, where, and why)
 - Making a hypothesis (an idea that can be tested by an experiment or an observation)
 - Planning the investigation (research topic and gather tools to perform experiment)
 - Collecting and recording data (gathering info using qualitative and quantitative responses)
 - Organizing data (graphs and tables)
 - Explaining results (What does the info mean?)
 - Thinking of a new question (Using the info to identify new questions.)
 - Sharing results
- **Variables:** a factor that can change in an experiment
- **Scientific Tools Used in Science Investigations:** Calculators, Microscopes, Cameras, Sound recorders, Computers, Hand lenses, Rulers, Thermometers, Compasses, Balances (Triple beam balance scales have three numbers that are added together to mass an object.), Hot plates, Magnets, Collecting nets, Safety goggles, Meter sticks, Timing devices, Graduated cylinders, and Beakers
- **Science Measurement** (using the metric system): time, volume, length, mass, and temperature
- **Interpreting Product Labels and Advertisements:** Read and infer product labels and advertisements from magazines and mail flyers. An inference is a reasonable conclusion based on what you observe.
- **Unifying Concepts**
 1. **Models** – Represent the natural world using models and identify their limitations; how are models useful; how are models similar to and different from the natural world
 2. **Systems**- Parts to whole; how do the parts interact
 3. **Change** – was there a change; what was the change; what caused the change; give examples of different types of change
 4. **Properties and Patterns** –how can properties be used to identify a pattern; what properties of objects were observed
 5. **Survival** – give examples of different types of survival

Life Science:

- Living things are called **organisms**. This includes both plants and animals.
- Organisms are made up of cells.
- Organisms have basic needs. **Animals** need air, water, food, and shelter. **Plants** require air, water, nutrients, and energy from the sun. **Plants** produce their own food. **Animals** are dependent on plants for their food source or other animals. Some animals eat plants (**herbivore**); and some animals eat animals that eat plants (**carnivore**); and some animals eat both animals and plants (**omnivore**).
- **Plants** have three main parts: **roots, stems, and leaves**. **Roots** take in water and anchor the plant in the soil. The **stem** moves water and minerals through the plant and supports the plant. The **leaves** are the “food factory”. Photosynthesis takes place in the leaves. Plants make their own food.
- **Photosynthesis:** the process of using the energy from sunlight, water, and carbon dioxide to make food (sugar) for the plant. The waste gas produced during photosynthesis is oxygen.
- Plants and animals have **life cycles** that include birth, developing into adults, reproduction and death. Some animals go through metamorphosis.
- **Metamorphosis** = change. **Complete metamorphosis** is a major change (egg, larva, pupa, and adult such as a butterfly or frog). An **incomplete metamorphosis**, the nymph resembles the adult (egg, nymph, and adult such as grasshoppers and dragonflies).
- **Inherited traits** are characteristics you inherit from your parents such as hair and eye color.
- **Instinctive behaviors** are inherited from parents. The animal is born with the behavior (a newborn foal struggles to its feet and walks).
- **Learned behaviors** are things you learn or you are taught by interacting with the environment (a colt may learn to wear a saddle and bridle).

- **Adaptive characteristics** are changes that organisms learn to help them survive (a bird eating from a bird feeder).
- **Adaptations** include: migration, hibernation, camouflage, mimicry, coloration, special adaptations, and or unique defenses
- Animals live in a home called a **habitat**. The role that an organism plays in habitat is called its **niche** {(1) predator or prey and (2) producer→consumer→decomposer}
- Many habitats make up an **ecosystem**. An ecosystem is where organisms interact with one another and the environment.
- A group of ecosystems in an area with the same climate and organisms is called a **biome**. Biomes include deserts, tropical rain forests, deciduous forests, grasslands, arctic tundra, and aquatic areas.
habitat → ecosystem → biome
- **Species** (individual of 1) → **population** (more than 1) → **community** (populations that live in the same place at the same time)
- **Predator** = animal that hunts other animals for food
- **Prey** = animal that is hunted and eaten
- **Producer** = makes its own food. All plants are producers.
- **Consumer** = eats things such as plants or animals. All animals are consumers.
- **Primary consumer** = eat plants (mice and rabbits eat plants)
- **Secondary consumer** = eat animals (owls and bobcats eat other animals)
- **Herbivores** = eat plants (mice and rabbits)
- **Carnivores** = eat meat (owls and bobcats)
- **Omnivores** = eat both (humans)
- **Decomposers** = an organism that gets energy by feeding on dead materials and wastes and connects both ends of the food chain. Decomposers help break down materials into particles that can be used by other decomposers or by plants (mushrooms and bacteria)
- **Food chain** = transfer of energy from one organism to another. All energy begins with the **sun → producer (plant) → mouse (consumer) → owl (consumer)**
- **Food web** = many connected food chains
- The movement of carbon dioxide and oxygen between organisms and the air is called the **oxygen and carbon dioxide cycle**. Oxygen exits plants and enters animals and carbon dioxide exits animals and enters plants. The carbon-dioxide cycle also occurs in aquatic biomes.
- The **nitrogen cycle**: the movement of nitrogen from the nonliving environment into living things and back again is known as the nitrogen cycle. 78% of the Earth's atmosphere is made of nitrogen gas until it is fixed by lightening and bacteria. Nitrogen then becomes ammonia and nitrates in the soil which can be absorbed by plant roots. Animal decomposition and waste are put back into the soil in the form of ammonia and nitrates and the cycle continues.
- The change of water from one state to another and its movement from one place to another on Earth is called the **water cycle**. The changes and movement of water during the water cycle are driven by the Sun's energy. The water cycle includes **evaporation, condensation, precipitation, and transpiration**.

Physical Science:

- All things are made of **matter**.
- The three states of matter are: **solid, liquid, gas**
- The amount of matter in an object is its **mass**. The force of gravity on an object is determined by the mass of the object. The mass of the object is completely independent of the Earth's gravitational pull. A body has the same mass whether it is on the Earth's surface or on the moon.
- The measure of the Earth's pull of gravity on a body is called the weight of that body. The weight of the body changes, depending on its distance from the center of the Earth. A body weighs less the greater the distance it is from the center of the Earth.
- **Weight** is measured using a spring scale (bathroom or grocery store scale). **Mass** is measured on a balance scale (triple beam or pan balance).
- **Matter** can be classified by the properties of the substance. Examples of properties are **color, odor, texture, conducts heat, magnetism, buoyancy (floats or sinks), solubility, density, boiling point, and melting point**.
- Matter can be put together in **mixtures** (fruit salad) and **solutions** (chocolate syrup and milk). Some matter can **dissolve** (salt dissolves in water).
- **Mixture** = 2 or more substances that can be easily separated and are unevenly mixed (water and marbles)

- **Solution** = 2 or more substances that evenly mixed and are difficult to separate (water and tea)
- Properties of a substance are used to separate mixtures (magnets separate iron from a mixture).
- Boiling point for water = **100° Celsius**
- Water freezes = **0° Celsius**
- Different substances can have different boiling and melting points.
- Some substances such as water can change to different states of matter by heating and cooling.
- As temperature ↑ (increases), ice changes to water and then to water vapor (adding heat)
- As temperature ↓ (decreases), water vapor changes to water and then to ice (taking heat away)
- Types of **energy: solar, electrical, nuclear, light, heat, chemical, mechanical, and sound**
- The **Sun** is a major source of energy. As the sun's light reaches Earth, the energy is transferred. The Sun's energy is called solar energy.
- **Energy can change form.**
- Potential energy = stored energy
- Kinetic energy = energy of motion
- Electrical circuits provide a means of transferring electrical energy to **heat** (electric toaster); **sound** (electric radio); **mechanical** (electric can opener) and **light** (electric lamp).
- **Electricity flows in a circuit.** If the circuit is broken the electrical flow stops.
- **Series circuit** = the electrical flow is a continuous loop
- **Parallel circuit** = the electric flow has a separate loop for each device
- **Conductors** are materials (copper) which allow electricity to move through them easily.
- **Insulators** are materials (rubber or plastic) which resist the flow of electricity.
- **Light** travels in a **straight line** until it strikes an object. Light travels in **light rays**.
- Light can be **reflected** (bounces back) by a mirror, water, or tinted windows.
- Light can be **refracted** (bend) by a lens in glasses, camera, and telescopes. Light travels through transparent (clear) objects.
- Light can be absorbed by an object. Light is absorbed by opaque objects. Dark objects absorb more light than light colored objects. This absorbed light can change to heat energy.
- **Sound** travels in **waves**. ≈ (**sound = vibration**) Vibrations make sound.
- The **pitch** of sound can be varied by changing the rate of the vibration.
- An object can move when a **force** is applied to it. **Gravity is a force**.
- **Friction** is how rough or smooth something is. The more friction, the more difficult it is to move. force = motion force = friction
- **Magnets** = attract or repel (North ends of magnets are attracted to south ends of other magnets. North to north ends repel each other)
- **Electromagnets** = magnets that work only when an electric current is flowing in a wire wrapped around an iron bar. These magnets are turned off and on by turning the electricity on and off to the wire coil.

Earth Science:

- Earth materials are rocks, soil, water and gases in the atmosphere.
- Earth materials provide many of the resources (natural resources) that organisms use.
- **Renewable resources** = plants, animals, rocks, soil, water, oxygen, carbon dioxide, and nitrogen
- Non-renewable resources = oil, natural gas, coal, minerals, and metals
- **Fossil fuels** = oil, natural gas, and coal (Were made from once living organisms. Because they take so long to form, they are considered to be non-renewable.)
- **Inexhaustible resources** = wind, solar, ocean tides
- **Land forms** = mountains, canyons, valleys, volcanoes, and plains
- The earth's surface can change. Slow change = **weathering** (water, wind, ice, and plants), **erosion** (moving water, wind, and moving ice), **deposition** (WED) Rapid change = **volcanic eruptions, earthquakes, tsunamis, landslides and floods**
- **Soil** helps plants grow. Some soils are better than others. Clay and sand are not good soils. Soils have properties of **color, texture, capacity to retain (hold) water and the ability to support the growth of many kinds of plants.**
- **Weathering** occurs when rock and soil is broken down into smaller pieces by wind, wind, ice and plants.
- **Erosion** occurs after weathering when the small pieces of rock and soil move to a new place.
- **Deposition** occurs when the pieces of rock and soil are left in a new place after erosion.

- **Canyons** are formed when rivers weather away the land over thousands of years. Flooding can cause more rapid erosion.
- **Mountains** are formed when land is squeezed together and or slides upward or downward along a fault.
- **Volcanoes** are formed when magma (melted and molten rock) pushes through the surface of the Earth. When the magma pushes through the surface of the Earth it becomes lava.
- **Earthquakes** can change the surface of the Earth.
- Some changes in the solid Earth can be described as the “**rock cycle**”. Old rocks at the Earth’s surface weather, forming new sediments that are buried, then compacted, heated, and often re-crystallized into new rock. Eventually those rocks are brought to the surface and cycle starts over again. **Sedimentary rock** is formed from small bits of rock, shells, and the remains of plants and animals which are cemented together. **Metamorphic rock** is formed from existing rock that have been squeezed and heated deep inside the Earth’s crust. **Igneous rock** is formed deep under ground where temperatures are high enough to melt rock.
- **Fossils** provide important evidence of how life and environmental conditions have changed. Fossils are the trace remains of organisms that lived long ago. Most fossils are found in sedimentary rock.
- **Layers of the Earth** include **inner core** (solid iron and nickel); **outer core** (liquid iron and nickel); **mantle** (melted rock) and **crust**
- The Earth and moon are alike because they are both spheres and made up of rock and soil.
- The Earth has water, living things, and an atmosphere. The moon does not.
- The Earth revolves around the Sun. The moon revolves around the Earth.
- The Earth has more gravity than the moon. The Earth is larger than the moon.
- Objects weigh less on the moon than the Earth because the moon has less gravitational pull. Objects are massed the same on the Earth and the moon because gravity does not affect mass.
- The Earth is warmer than the moon. The light of the moon is the reflection of the Sun.
- The Earth rotates on its axis every 24 hours or one day. The Earth rotates from west to east.
- The Earth revolves around the Sun once every 365 days (1 year) in an elliptical orbit.
- The tilt of the Earth creates seasons. When our half of the world is tilted toward the Sun we have summer. When our half of the world is tilted away from the Sun we have winter.
- The **moon** rotates on its axis and revolves around Earth. One rotation and one revolution take the same amount of time (approx. 28 days). Because the rotation and the revolution take place at the same time, the same side of the moon always faces Earth.
- The **lunar cycle** takes place approximately every 28 days. The 4 phases of the moon include new moon (1), quarter moon (2), and full moon (1).
- **new moon** → waxing crescent → **first quarter** → waxing gibbous → **full moon** → waning gibbous → **last quarter** → waning crescent and then back to a new moon
- **Tides** (2) are caused mostly by the pull of gravity between Earth and its moon. There is high tide and low tide, then a second high and low tide occurring about every six hours.
- The **Sun** corona (the light around it) and sunspots (cool areas on the sun that look darker). The Sun is made up of very hot gases. The Sun is a major source of energy for the phenomena on the Earth’s surface, such as growth of plants, the creation of wind, ocean currents, and the water cycle. Seasons result form variations in the amount of Sun’s energy hitting the surface, due to the tilt of the Earth’s axis and the length of day.
- **Wind is moving air.** As the Sun’s energy transfers to the surface of the Earth uneven heating and cooling occurs. (Considering the shape of the Earth and the many land forms found on the Earth’s surface, it is easy to see how the uneven heating and cooling occurs.) Warm air rises while cool air sinks. The uneven heating and cooling cycle creates wind.
- **Gravity** is the force that keeps the 8 planets in orbit around the Sun. The planets in the Solar System include: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune. Pluto has been reclassified as a Dwarf Planet. Gravity holds us to the Earth’s surface and explains the phenomena of the tides.

- **Weather** (climate) is different in different places on the Earth. It is warmer near the equator. It is colder near the North and South Poles. It rains more near oceans, mountains, and the equator.
- **Cycles:** life, water, oxygen-carbon dioxide, nitrogen, rock, lunar, and seasons

Conservation:

- Make wise choices in the use and conservation of resources.
- Natural resources include soil, water, air, rocks and minerals, plants and animals.
- Pollution is anything in the environment that can harm living things or damage natural resources.
- Air pollution is created by harmful substances that get into the air. Acid rain is a result of rain from the atmosphere passing through polluted air.
- Water pollution is created by harmful substances that get into water.
- **Reduce** the amount of natural resources we use.
- **Reuse** glass and plastic containers by washing and using again.
- **Recycle** glass bottles and jars, aluminum cans, plastic containers (look for the Δ symbol), and paper.
- Protect wildlife from extinction (when the last member of a species dies)