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* All plants are multicellular
* All plants have a life cycle made up of two stages: ***sporophyte*** and ***gametophyte***.
* Sporophyte stage, plants make spores that are genetically identical to the parent plant.
* Gametophyte stage, plants produce gametes
* Female gametophytes produce eggs and male gametophytes produce sperm.
* Eggs and sperm are sex cells
* **Sexual reproduction**- sperm cells fertilize egg cells. Fertilized egg can grow into a sporophyte, and the cycle can begin again
* **Cell wall**- supports and protects plant cells, it determines the size and shape of plant cell, its main component is a carbohydrate called cellulose, its strength helps plant stand up
* Inside a plant cell is a large **central vacuole**, a membrane-bound organelle that stores water and helps to keep the plant upright. If the vacuole loses water, the plant begins to wilt.
* Plants can be grouped into two categories: nonvascular and vascular
* **Nonvascular plants-** do not have a vascular system such as mosses, moves from the environment and throughout the plant by **diffusion**, usually small
* **Vascular plants-** the vascular systemhas tube-like tissues that transport water, nutrients, and other materials from one part of an organism to another
  + body of a vascular plant is divided into two systems: the root system and the shoot system
  + The **root system** is made of roots and other underground structures.
  + The above-ground structures, such as stems, leaves, and flowers, make up the **shoot system**.
  + The three major organs of vascular plants are roots, stems, and leaves.
  + Vascular tissue transports water and materials between roots and shoots.
* **seed** is a plant embryo enclosed in a protective coating (shell). Endosperm is the stored food in the seed the embryo uses until it grows its leaves.
* **pollen-** a tiny structure in which sperm forms. The sperm cell fertilizes an egg cell, which develops into an embryo inside a seed
* Seed plants are classified based on whether or not their seeds are enclosed in a fruit. **Gymnosperms** are plants that produce seeds that are not enclosed in a fruit (ex. conifers… pine trees)
* **Angiosperms** are vascular plants that produce flowers and fruits that surround and protect seeds. Flowers are reproductive structures of angiosperms
* The seed develops in the ovary at the base of the pistil. The ovary matures into a fruit covering the seed.
* Almost all plants are **producers**. Producers make their own food by using energy from their surroundings.
* **Photosynthesis-** The process that plants and other organisms use to convert solar energy to chemical energy**,** occurs in **chloroplast**. Chloroplasts contain special pigments called chlorophyll
* **Chlorophyll** is a green pigment that captures energy from sunlight, Chloroplasts use this energy, along with carbon dioxide and water, to make food in the form of a sugar called **glucose.** In the same process, oxygen gas is released
* During photosynthesis, plants take in light energy, carbon dioxide, and water then release oxygen
* **cellular respiration**- cells use oxygen to release stored energy from the bonds of sugar molecules, it produces carbon dioxide and water
* SPOROPHYTE🡪 spore produced🡪 GAMETOPHYTE🡪 sperm and eggs produced🡪 sperm fertilizes egg and makes a seed🡪 SPOROPHYTE (cycle repeats)
* Seedless plants (ex. moss) have sperm swim to eggs through use of water
* Pollen carried by wind, water, or animals
* **Pollination** happens when pollen lands on
* and fertilizes the female plant reproductive structure
* Be able to label parts on the flower: Pistil, Stigma, Ovary, Ovule, Egg, Stamen, Anther, filament, petal, sepal
* Stamen is the male reproductive structure, pistil is the female reproductive organ
* Perfect flower has pistil and stamen. Imperfect flower has stamen but no pisitil or a pistil but no stamen.
* A **stamen** is the male reproductive structure of flowers. At the tip of each is an *anther*, where pollen is produced.
* A **pistil** is the female reproductive structure of flowers. When pollen reaches the tip of a pistil, called the *stigma*, pollination occurs.
* A pollen tube grows down through the pistil into the ovary, where one or more ovules contain eggs.
* Sperm travel into the ovary and fertilize the eggs, which develop an embryo: a tiny, undeveloped plant
* The ovule develops into a seed that surrounds and protects the embryo. The ovary becomes a fruit, which protects the seeds and helps them spread.
* Asexual reproduction allows a plant to reproduce without seeds or spores. Part of a parent plant, such as a stem or root, produces a new plant (ex. strawberries, potatoes)
* The loss of water from leaves is called **transpiration**.
* A plant wilts when it loses more water than it can absorb through roots. When a plant is wilting, its stomata close, preventing further water loss.
* Plant growth in response to a stimulus is called a **tropism**.
  + Plant tropisms are controlled by plant hormones, which are chemical messengers that cause changes in cells.
  + A change in the direction of plant growth in response to light is called phototropism.
  + Hormones build up in cells on the shaded side of the stem, causing them to lengthen, which makes the stem bend toward the light.
  + A change in the direction of plant growth in response to gravity is called gravitropism
* Most stems grow up, away from Earth’s gravitational pull, and most roots grow down, toward pull of gravity.
* **Dormant** describes the inactive state of a seed or other plant part when conditions are not right for growth.
* Some plants shut down during winter or a dry season, living off of stored sugars.
* Many plants come out of dormancy in the spring, triggered by more direct sunlight, longer days, and increased rain.
* A plant’s growing season occurs when temperature, light, and water conditions favor growth for that type of plant.
* Out-of-season produce is grown in a greenhouse or shipped from other parts of the world
* PLANT ADAPTATIONS:
  + Desert- pollinated at night b/c cooler, hairs for shade, spines protect water from animals, deep roots, waxy, some half short life cycle that occurs as soon as it rains
  + Grasslands/Prairie- wind carries pollen, deep roots to get water and keep animals from pulling up, regrow after fires easily, thick bark to resist fire, flexible leaves for wind
  + Rainforest- shallow roots, canopy 12 hours of sun, wax leaves to prevent bacteria, plants may grow on or climb other plants to get to sun, animals attracted to flowers and act as pollinators
  + Tundra- hair to keep warm, grow in clumps to keep warm, dark in color to absorb sun heat, small
  + Taiga- lots of evergreens so photosynthesis can occur as soon as temp rises, conifers, needle leaves
  + Deciduous- thick bark for winters, shed leaves in winter then regrow, many levels of plants
  + Water- chlorophyll stays at top of leaves, gets nutrients from water, roots used for anchoring not nutrients