Name_____ Class_____ Date _____

Summary

22–1 Introduction to Plants

Plants provide the base for food chains on land. They also provide shade, shelter, and oxygen for animals. Plants are many-celled organisms with cells walls made of cellulose. They make their own food in the process of photosynthesis using green pigments called chlorophyll *a* and *b*.

Plant life cycles have two phases that alternate. A diploid (2N) phase, called the sporophyte, alternates with a haploid (N) phase, called the gametophyte. This is known as alternation of generations. The sporophyte produces haploid spores. The spores grow into haploid gametophytes. The gametophyte produces male and female reproductive cells, called gametes. Male and female gametes fuse during fertilization to produce a new sporophyte.

In order to survive, all plants need sunlight, water, minerals, oxygen, carbon dioxide, and a way to move water and nutrients to their cells. Plants have many adaptations to get these things.

Early land plants evolved from an organism that was like the multicellular green algae living today. As early land plants adapted to a dry habitat, several major groups of plants evolved. Botanists divide modern plants into four groups based on water-conducting tissues, seeds, and flowers. These four plant groups are mosses and their relatives, ferns and their relatives, cone-bearing plants, and flowering plants.

22–2 Bryophytes

Mosses, liverworts, and hornworts belong to the group called bryophytes. Bryophytes do not have tubes to move water and nutrients through the plant. Water simply moves from cell to cell. It moves from areas where there is plenty of water to areas where water is needed.

Bryophytes do not have true leaves, stems, and roots. Instead of roots, they have structures called rhizoids. Rhizoids anchor the plant to the ground.

Bryophytes reproduce sexually and asexually. They have several structures that produce reproductive cells. Structures called antheridia make sperm. Structures called archegonia produce egg cells.

Sperm cells must swim through water to fertilize eggs. This is why bryophytes must live in moist habitats. After fertilization, the diploid zygote grows to become a sporophyte. The sporophyte is made up of a capsule and a long stalk that remains attached to the gametophyte. It relies on the gametophyte for food and water. Spores are made inside the capsule. When the capsule ripens, it opens and the spores are carried off by wind and water. When a spore lands in a moist place, it grows into the plant we think of as moss. This green plant is the haploid gametophyte.

22–3 Seedless Vascular Plants

Ferns and their relatives were the first plants to have special tissues that carry water and food throughout a plant. These tissues are called vascular tissues. There are two types of vascular tissue. Xylem moves water from the roots to all parts of the plant. Special cells call tracheids make up xylem. They have thick, strong cell walls. The other type of vascular tissue is phloem. Phloem carries nutrients and food from place to place within the plant.

Seedless vascular plants include club mosses, horsetails, and ferns. These plants have true roots, leaves, and stems. Roots absorb water and minerals. Leaves make food by photosynthesis. Stems support the plant and connect leaves and roots.

In the life cycle of ferns, the diploid sporophyte is the dominant stage. Fern sporophytes produce spores on the underside of the fronds. These spores are haploid.

When spores are ripe, they burst from sporangia and are carried by wind and water. In the right conditions, they will grow to form haploid gametophytes.

The haploid gametophyte is a thin, heart-shaped structure. The antheridia and archegonia are found on the underside of the gametophyte. When mature, sperm from the antheridia swim to the archegonia to fertilize the eggs.

22–4 Seed Plants

Seed plants are divided into two groups: gymnosperms and angiosperms. Gymnosperms, or cone-bearing plants, produce seeds directly on the surface of cones. Angiosperms, which are flowering plants, produce seeds inside a tissue that protects them.

Like other plants, seed plants have alternation of generations. All of the seed plants that we see are sporophytes. The gametophytes of seed plants are made up of only a few cells. They grow and mature within flowers and cones. The entire male gametophyte fits in a tiny structure called a pollen grain. Pollen is carried to the female gametophyte by wind, birds, mammals, or insects. This process is called pollination.

Seeds protect the zygote of seed plants. After fertilization, the zygote grows into a tiny plant. This plant is called an embryo. When conditions are right, the embryo grows. It uses a supply of stored food inside the seed when it starts growing. A seed coat surrounds the embryo, protecting it from drying out.

Gymnosperms are the oldest surviving seed plants. Gymnosperms include gnetophytes, cycads, ginkgoes, and conifers. These plants produce seeds that are protected by a seed coat. However, the cone does not cover the seeds. This is why they are called naked seed plants.

22–5 Angiosperms—Flowering Plants

Angiosperms have reproductive organs called flowers. Flowers attract animals, which carry pollen from flower to flower. This is a more efficient way of pollination than the wind pollination of most gymnosperms. Unlike gymnosperms, the seeds of angiosperms are protected. The structure that protects the seeds develops into a fruit.

There are two groups of angiosperms: monocots and dicots. Monocot embryos have one seed leaf, or cotyledon. Dicot embryos have two cotyledons. Other differences include the arrangement of veins in leaves, the number of flower petals, the structure of roots, and the arrangement of vascular tissue in the stem.

Flowering plants have three different life spans. Annuals complete their life cycle within one growing season. Biennials complete their life cycle in two years. They produce seeds and die in the second growing season. Perennials live through many years. Some die each winter and regrow in spring. Others have woody stems.