

Evolutionary Theory

Section: Developing a Theory

A THEORY TO EXPLAIN CHANGE OVER TIME

Key Idea: Modern _____ began when _____ presented evidence that _____ and offered an _____ of how _____.

Evolution is _____

Additional notes about A Theory to Explain Change Over Time: _____

Reading Check: What does evolution mean in biology? _____

DARWIN'S IDEAS FROM EXPERIENCE

Key Idea: Darwin's experiences provided him with evidence of _____

Artificial selection is _____

The word **insight** means _____

Additional notes about The Voyage of the *Beagle*: _____

Additional notes about Years of Reflection: _____

601

Additional notes about Breeding and Selection: _____

Reading Check: When did Darwin first see evidence of evolution? _____

DARWIN'S IDEAS FROM OTHERS

Key Idea: Darwin was influenced by ideas from the fields of _____,
_____, _____, and _____.

Additional notes about Lamarckian Inheritance: _____

Additional notes about Population Growth: _____

Additional notes about Geology and an Ancient Earth: _____

Reading Check: What belief did Darwin and Lamarck share? _____

Evolutionary Theory

Section: Applying Darwin's Ideas

EVOLUTION BY NATURAL SELECTION

Key Idea: Darwin's theory predicts that over time, the number of individuals that carry _____ traits will increase in population.

Natural selection is _____

Adaptation is a _____

Steps of Darwin's Theory

Step 1: _____

Step 2: _____

Step 3: _____

Step 4: _____

Additional notes about Steps of Darwin's Theory: _____

Additional notes about Selection and Adaptation: _____

Additional notes about Publication of the Theory: _____

Reading Check: Is natural selection the same thing as evolution? _____

WHAT DARWIN EXPLAINED

Key Idea: Darwin presented a unifying explanation for _____
from multiple fields of science.

A fossil is _____

Homologous describes _____

The word **infer** means _____

Additional notes about The Fossil Record: _____

Additional notes about Biogeography: _____

Additional notes about Developmental Biology: _____

Reading Check: Why is the fossil record incomplete? _____

Additional notes about Anatomy: _____

Additional notes about Biochemistry: _____

Reading Check: What explains similarities in bone structure?

604 **EVALUATING DARWIN'S IDEA**

Key Idea: Darwin's work had three major strengths: _____

Additional notes about Strengths: _____

Additional notes about Weaknesses: _____

Reading Check: What did Darwin do before publishing his ideas?

Evolutionary Theory

Section: Beyond Darwinian Theory

DARWIN'S THEORY UPDATED

Key Idea: Discoveries since _____, especially in _____
have been added to his theory to explain _____.

Additional notes about Remaining Questions: _____

STUDYING EVOLUTION AT ALL SCALES

Key Idea: Because it affects every aspect of biology, scientists can study
_____ at many scales. Generally, these scales range from
_____ to _____.

Speciation is _____

The word **random** means _____

Additional notes about Speciation: _____

Additional notes about Processes of Microevolution: _____

Additional notes about Patterns of Macroevolution: _____

Reading Check: At what scales can evolution be studied? _____

Population Genetics and Speciation

Section: Genetic Variation

POPULATION GENETICS

Key Idea: _____ can be studied by observing changes in the numbers and types of _____ in populations.

Population genetics is the study of _____

Additional notes about Population Genetics: _____

Reading Check: What do we now know about heredity that Darwin did not know? _____

PHENOTYPIC VARIATION

Key Idea: Biologists study _____ by measuring each individual in the population and then analyzing the distribution of the measurements.

Normal distribution is _____

Additional notes about Phenotypic Variation: _____

Reading Check: Why do polygenic characters vary so much?

MEASURING VARIATION AND CHANGE

Key Idea: Genetic variation and change are measured in terms of the frequency of _____ in the gene pool of a population

Additional notes about Studying Alleles: _____

Reading Check: What is the main measure of genetic variation? _____

The word *normal* in science and math is often used to describe measurements that fit within a normal distribution. What does a doctor mean when talking about "normal height" for a person of your age? _____

$$(\text{frequency of } E) + (\text{frequency of } e) = 1$$

$$\frac{(\text{count of } E)}{(\text{total})} + \frac{(\text{count of } e)}{(\text{total})} = 1$$

Additional notes about Tracking Frequencies: _____

Reading Check: What is the sum of all allele frequencies for any one gene? _____

SOURCES OF GENETIC VARIATION

Key Idea: The major source of new _____ in natural populations is _____ in _____ cells.

The word **generate** means _____

Additional notes about Sources of Genetic Variation: _____

Reading Check: Why is mutation so important? _____

Population Genetics and Speciation

Section: Genetic Change

EQUILIBRIUM AND CHANGE

Key Idea: The _____ predicts that the frequencies of alleles and genotypes in a population will not change unless at least _____ acts upon the population.

Genetic equilibrium is _____

Additional notes about Measuring Change: _____

Additional notes about Hardy-Weinberg Principle: _____

Additional notes about Forces of Genetic Change: _____

Reading Check: What can cause gene flow? _____

SEXUAL REPRODUCTION AND EVOLUTION

Key Idea: Sexual reproduction creates the possibility that _____ or _____ can influence the gene pool of a population.

Additional notes about Sexual Reproduction and Evolution: _____

⁶⁰⁹
POPULATION SIZE AND EVOLUTION

Key Idea: Allele frequencies are more likely to remain stable in _____ populations than in _____ populations.

Additional notes about Population Size and Evolution: _____

Reading Check: What is the genetic effect of inbreeding? _____

NATURAL SELECTION AND EVOLUTION

Key Idea: _____ acts only to change the relative frequency of alleles that exist in a population.

The word **deviate** means _____

Additional notes about How Selection Acts: _____

Additional notes about Genetic Results of Selection: _____

Reading Check: How is "fitness" measured in evolutionary terms? _____

Additional notes about Why Selection is Limited: _____

Reading Check: How can unfavorable alleles persist? _____

610

List possible exceptions to the statement "Natural selection removes unsuccessful phenotypes from a population." _____

PATTERNS OF NATURAL SELECTION

Key Idea: Three major patterns are possible in the way that natural selection affects the distribution of polygenic characters over time: _____

Additional notes about Directional Selection: _____

Additional notes about Stabilizing Selection: _____

Additional notes about Disruptive Selection: _____

Reading Check: Which form of selection increases the range of variation in a distribution? _____

Population Genetics and Speciation

Section: Speciation

DEFINING SPECIES

Key Idea: Today, scientists may use more than one definition for _____.

The definition used depends on _____ and _____
_____ being studied.

Additional notes about Defining Species: _____

Reading Check: Why is a species hard to define? _____

FORMING NEW SPECIES

Key Idea: Speciation has occurred when the net effects of evolutionary forces result in a population that has _____

Reproductive isolation is _____

A subspecies is _____

Additional notes about Reproductive Isolation: _____

Additional notes about Mechanisms of Isolation: _____

Reading Check: Is hybridization always successful? _____

EXTINCTION: THE END OF SPECIES

Key Idea: The species that exist at any time are the next result of both

_____ and _____.

Additional notes about Extinction: The End of Species: _____

Reading Check: When do we know that extinction has happened?

Classification

Section: The Importance of Classification

THE NEED FOR SYSTEMS

Key Idea: Biologists use _____ to
organize their knowledge of organisms. These _____ attempt to
provide consistent ways to name and categorize organisms.

Taxonomy is _____

Additional notes about The Need for Systems: _____

Reading Check: What is the problem with common names of species? _____

SCIENTIFIC NOMENCLATURE

Key Idea: All scientific names for species are made up of two _____
or _____-like terms.

Genus is _____

Binomial Nomenclature is a _____

Additional notes about Early Scientific Names: _____

Additional notes about Naming Rules _____

Reading Check: Why did Linnaeus devise a new naming system? _____

THE LINNAEAN SYSTEM

Key Idea: In the Linnaean system of classification, organisms are grouped at successive levels of a hierarchy based on similarities in their _____ and _____.

Levels of the Linnaean System

Domain

Phylum

Family

Species

Additional notes about Levels of the Modern Linnaean System: _____

Reading Check: How many kingdoms are in the Linnaean system?

Classification

Section: Modern Systematics

TRADITIONAL SYSTEMATICS

Key Idea: Scientists traditionally have used similarities in _____ and _____ to group organisms.

However, this approach has proven _____.

Additional notes about Traditional Systematics: _____

Reading Check: What is systematics? _____

PHYLOGENETICS

Key Idea: Grouping organisms by _____ is often assumed to reflect phylogeny, but inferring phylogeny is complex in practice.

Phylogeny is the _____

Additional notes about Phylogenetics: _____

CLADISTICS

Key Idea: Cladistic analysis is used to select the most likely _____ among a given set of organisms.

Cladistics is a _____

The word **objective** means _____

Additional notes about Cladistics: _____

The word root *clad* means "shoot, branch or twig" and the word root *gram* means "to write or record." Use this information to analyze the meaning of the term *cladogram*. _____

Reading Check: What does a cladogram show? _____

INFERRING EVOLUTIONARY RELATEDNESS

Key Idea: Biologists compare many kinds of _____ and apply _____ carefully in order to infer phylogenies.

Morphology refers to _____

Molecular evidence includes _____

Reading Check: What is an example of morphological data? _____

The principle of parsimony holds that _____

Additional notes about Inferring Evolutionary Relatedness: _____

Reading Check: What kinds of molecular data inform cladistics? _____

Classification

Section: Kingdoms and Domains

UPDATING CLASSIFICATION SYSTEMS

Key Idea: Biologists have added _____ and _____
to classification systems as they have learned more.

Additional notes about Updating Classification Systems: _____

Reading Check: What were the original Linnaean kingdoms? _____

THE THREE-DOMAIN SYSTEM

Key Idea: Today, most biologists tentatively recognize _____
domains and _____ kingdoms.

Bacteria are _____

Archaea are _____

A eukaryote is an _____

Major characteristics used to define kingdoms include:

cell type

body type

Additional notes about Major Characteristics: _____

Additional notes about Domain Bacteria: _____

Additional notes about Domain Archaea: _____

The major groups of eukaryotes include:

Plantae

Protista

Additional notes about Domain Eukarya: _____

Reading Check: Which kingdoms are prokaryotic? _____

Reading Check: Which kingdoms are heterotrophic? _____

History of Life on Earth

Section: How Did Life Begin?

THE BASIC CHEMICALS OF LIFE

Key Idea: The _____ experiment showed that, under certain conditions, _____ compounds could form from _____ molecules.

Additional notes about The Miller-Urey Experiment: _____

Reading Check: What compounds were formed in the Miller-Urey experiment? _____

LIFE'S BUILDING BLOCKS

Key Idea: Among the hypotheses that address the origin of life, one states that early _____ formed close to _____ cents. Organic molecules may have also arrived on early Earth in _____.

The word **impact** means _____

Additional notes about Hydrothermal Vents: _____

Additional notes about Space: _____

620 **THE FIRST CELLS**

Key Idea: Many scientists think that the formation of _____
may have been the first step toward cellular organization.

A **microsphere** is a _____

A **ribozyme** is a _____

Additional notes about Forming a Cell: _____

Additional notes about Origin of Heredity: _____

Reading Check: Explain how RNA could have existed before DNA. _____

History of Life on Earth

Section: The Age of Earth

THE FOSSIL RECORD

Key Idea: Both the geographical distribution of organisms and when they lived on Earth can be inferred from _____, which chronicles the diversity of life on Earth.

A fossil record is _____

Additional notes about How Fossils Form: _____

ANALYZING FOSSIL EVIDENCE

Key Idea: In order to analyze fossil evidence, paleontologists use both _____ and _____ dating methods to date fossils.

Relative dating is a _____

Radiometric dating is a _____

Half-life is _____

Additional notes about Types of Fossils: _____

Additional notes about Relative Age: _____

Additional notes about Absolute Age: _____

Reading Check: What is the law of superposition? _____

DESCRIBING GEOLOGIC TIME

Key Idea: The geologic time scale is based on evidence in the _____
_____ and has been shaped by mass _____.

The geologic time scale is _____

Mass extinction is _____

Earth's history is divided into three eras:

Paleozoic Era _____

Mesozoic Era _____

Cenozoic Era _____

Additional notes about Divisions of Geologic Time: _____

Additional notes about Mass Extinction: _____

Reading Check: What evidence shows that mass extinctions occur?

History of Life on Earth

Section: Evolution of Life

PRECAMBRIAN TIME

Key Idea: Single-celled _____ and later, _____, evolved and flourished in _____ time.

The evolution of _____ set the stage for the evolution of modern organisms. The accumulation of _____ allowed organisms to live on land.

Cyanobacteria are _____

Endosymbiosis is a _____

The word **accumulate** means _____

Additional notes about Prokaryotic Life: _____

Additional notes about Formation of Oxygen: _____

Additional notes about Eukaryotic Life: _____

Observations that support the theory of endosymbiosis include:

Size and Structure: _____

Genetic Material: _____

Ribosomes: _____

Reproduction: _____

Additional notes about Origin of Energy-Producing Organelles: _____

Additional notes about Multicellularity: _____

Additional notes about Dominant Life: _____

Additional notes about Mass Extinctions: _____

Reading Check: Why is the evolution of colonial organisms an important step in evolution? _____

PALEOZOIC ERA

Key Idea: During the Paleozoic Era, marine _____ diversified, and marine _____ evolved. The first _____ evolved. Some _____, and then some _____, left the oceans to colonize land.

Additional notes about Dominant Life: _____

Additional notes about Mass Extinctions: _____

MESOZOIC AND CENOZOIC ERAS

Key Idea: _____, _____, and _____

were the dominant animals during the _____ Era, and

_____ dominated the

_____ Era.

Additional notes about Dominant Life: _____

Additional notes about Mass Extinction: _____

Bacteria and Viruses

Section: Bacteria

WHAT ARE PROKARYOTES?

Key Idea: Prokaryotes are divided into two major groups: the domain

_____ and the domain _____.

Additional notes about Archaea: _____

Additional notes about Bacteria: _____

BACTERIAL STRUCTURE

Key Idea: _____ bacteria have a thick

layer of _____ and no outer membrane. _____

_____ bacteria have a thin layer of _____ and

have an outer membrane.

A **plasmid** is a _____

Peptidoglycan is a _____

Gram-positive is a _____

Gram-negative is a _____

627

Additional notes about Gram-Positive Bacteria: _____

Additional notes about Gram-Negative Bacteria: _____

Reading Check: Is *E. coli* a Gram-positive or Gram-negative bacterium?

OBTAINING ENERGY AND NUTRIENTS

Key Idea: Grouping prokaryotes based on their energy source separates them into _____, _____, and _____.

Additional notes about Photoautotrophs: _____

Additional notes about Chemoautotrophs: _____

Additional notes about Heterotrophs: _____

REPRODUCTION AND ADAPTATION

Key Idea: Prokaryotes reproduce by binary fission; _____

_____, _____,
and _____; and survive harsh conditions by forming

_____.

Conjugation is _____

Transformation is _____

Transduction is _____

Endospore is _____

Additional notes about Binary Fission: _____

Additional notes about Genetic Recombination: _____

Additional notes about Endospore Formation: _____

Bacteria and Viruses

Section: Viruses

IS A VIRUS ALIVE?

Key Idea: Viruses are _____ living because they _____
_____ key characteristics of living organisms.

Additional notes about Is a Virus Alive?: _____

VIRAL STRUCTURE

Key Idea: All viruses have _____ and a _____.

A capsid is a _____

An envelope is a _____

A bacteriophage is a _____

Additional notes about Nucleic Acids: _____

Additional notes about Capsid: _____

Additional notes about Envelope: _____

Additional notes about Tail Fibers: _____

Reading Check: How does reproduction differ between DNA and RNA viruses? _____

REPRODUCTION

Key Idea: Viruses can reproduce by a _____ life cycle and a _____ life cycle.

Lytic is a _____

Lysogenic is a _____

Additional notes about Lytic Cycle: _____

Additional notes about Lysogenic Cycle: _____

VIROIDS AND PRIONS

Key Idea: Viroids and prions are molecules that are able to _____ and _____.

Additional notes about Viroids: _____

Additional notes about Prions: _____

Bacteria and Viruses

Section: Bacteria, Viruses, and Humans

ROLES OF BACTERIA AND VIRUSES

Key Idea: Bacteria play important roles in the _____ and in _____ . Both bacteria and viruses are important in research.

Additional notes about Bacteria and the Environment: _____

Additional notes about Bacteria and Industry: _____

Additional notes about Bacteria, Viruses, and Research: _____

KOCH'S POSTULATES AND DISEASE TRANSMISSION

Key Idea: The four main steps in Koch's postulates are _____

Koch's postulates is a _____

A pathogen is an _____

Additional notes about Koch's Postulates and Disease Transmission:

Reading Check: What are five ways diseases can be transmitted? _____

BACTERIAL DISEASES

Key Idea: Bacteria can cause disease by producing _____ and
by _____.

A **toxin** is a _____

Additional notes about Bacterial Diseases: _____

Use the two-column table below. In the "Effect" column, list all of the diseases discussed in this section. In the "Cause" column, list the pathogen that causes the disease, and note whether the pathogen is a bacterium or a virus.

Cause	Effect

ANTIBIOTIC RESISTANCE

Key Idea: Antibiotic resistance spreads when sensitive populations of
_____ are killed by _____. As a result, resistant
bacteria _____.

633

An **antibiotic** is a _____

Resistance is _____

The word **effective** means _____

Additional notes about Development of Resistance: _____

Additional notes about Consequences of Resistance: _____

VIRAL DISEASES

Key Idea: Because viruses enter _____ to reproduce, it is difficult to develop a drug that kills the virus without harming the living host.

Additional notes about Viral Diseases: _____

Reading Check: What factors cause the symptoms of viral disease?

EMERGING DISEASES

Key Idea: Emerging diseases are infectious diseases that are _____, that have _____, or that have _____

when a disease that was once considered under control begins to spread.

Additional notes about Emerging Diseases: _____

Protists

Section: Characteristics of Protists

WHAT ARE PROTISTS?

Key Idea: Protists are _____ organisms that cannot be classified as _____, _____ or animals.

Additional notes about What Are Protists?: _____

Reading Check: what important characteristics arose among protists during their evolution? _____

REPRODUCTION

Key Idea: Protists can reproduce asexually by _____, _____, and _____. Protists can also reproduce sexually by _____ of _____.

A gamete is a _____

Zygote is _____

Zygospore is _____

The alternations of generations is _____

Binary Fission: _____

Budding: _____

Fragmentation: _____

Additional notes about Asexual Reproduction: _____

Additional notes about Sexual Reproduction: _____

Reading Check: How does alternation of generations differ from sexual reproduction in unicellular protists? _____

The Greek word root *phyte* means “plant.” Using this information, propose your own definitions for *sporophyte* and *gametophyte*. _____

CLASSIFYING PROTISTS

Key Idea: The classification of organisms currently grouped in _____

_____ is likely to _____ as scientists learn

more about _____ and _____

Additional notes about Classifying Protists: _____

Protists

Section: Groups of Protists

GROUPING PROTISTS

Key Idea: Grouping protists by the way they _____
_____ helps us understand their ecological roles.

Additional notes about Grouping Protists: _____

Reading Check: What method can be used to group protists? _____

ANIMAL-LIKE PROTISTS

Key Idea: Animal-like protists _____ other organisms to

A pseudopodium is a _____

The word variety means _____

Additional notes about Amoeboid Protists: _____

Additional notes about Ciliates: _____

Additional notes about Flagellates: _____

Additional notes about Sporozoans: _____

Reading Check: Which group of protists is all parasitic? _____

PLANTLIKE PROTISTS

Key Idea: Plantlike protists obtain energy through _____.

Additional notes about Diatoms: _____

Additional notes about Euglenoids: _____

Additional notes about Dinoflagellates: _____

Reading Check: In which group of protists do the individuals get smaller every time they reproduce asexually? _____

Write a general statement that describes plantlike protists. _____

Find two exceptions to this general statement. _____

Additional notes about Red Algae: _____

Additional notes about Brown Algae: _____

Additional notes about Green Algae: _____

FUNGUSLIKE PROTISTS

Key Idea: _____ protists absorb _____ from
their environment and reproduce by _____.

A plasmodium is _____

Additional notes about Slime Molds: _____

Additional notes about Water Molds and Downy Mildews: _____

Protists

Section: Protists and Humans

PROTISTS AND DISEASE

Key Idea: Protists _____ a number of human diseases, including giardiasis, amebiasis, toxoplasmosis, trichomoniasis, cryptosporidiosis, Chagas disease, and malaria.

The word **rarely** means _____

Giardiasis

Cause: _____

Symptoms: _____

Amebic Dysentery

Cause: _____

Symptoms: _____

Toxoplasmosis

Cause: _____

Symptoms: _____

Trichomoniasis

Cause: _____

Symptoms: _____

Cryptosporidiosis

Cause: _____

Symptoms: _____

Chagas Disease

Cause: _____

Symptoms: _____

Malaria

Cause: _____

Symptoms: _____

Additional notes about Protists and Disease: _____**PROTISTS AND THE ENVIRONMENT**

Key Idea: Protists produce _____, take up _____, are important producers in _____ food webs, can produce _____, serve as _____ and have _____ relationships with many animals and plants.

An algal bloom is a _____

Additional notes about Protists and the Environment: _____

Reading Check: What are three ways in which protists affect ocean ecosystems? _____

PROTISTS AND INDUSTRY

Key Idea: Protists are important in many _____, in industrial and consumer _____, and in _____.

Additional notes about Protists and Industry: _____

641 Fungi

Section: Characteristics of Fungi

WHAT ARE FUNGI?

Key Idea: Fungi have _____ bodies, their cell walls are made of _____, and they absorb _____.

A **chitin** is _____

Additional notes about What Are Fungi?: _____

STRUCTURE AND FUNCTION

Key Idea: A typical fungal body is made of _____ that allow the fungus to have a _____ surface area and to absorb nutrients efficiently.

A **hypha** is _____

The **mycelium** is the _____

A **rhizoid** is a _____

A **saprobe** is an _____

Additional notes about Body Structure: _____

642

Additional notes about Obtaining Nutrients: _____

REPRODUCTION

Key Idea: In sexual reproduction, _____ are produced by

_____. In asexual production, _____ are

produced by _____.

Additional notes about Sexual Reproduction: _____

Additional notes about Asexual Reproduction: _____

Additional notes about Yeast and Mold: _____

Reading Check: What is the difference between spores produced sexually and spores produced asexually in fungi? _____

Write two sentences that compare and two sentences that contrast sexually and asexually produced by spores. _____

Fungi

Section: Groups of Fungi

CHYTRID FUNGI

Key Idea: The _____ are a group of _____
fungi that provide clues about _____.

Additional notes about Chytrid Fungi: _____

Reading Check: Which characteristics do chytrids share with protists, and which do they share with other fungi? _____

ZYGOTE FUNGI

Key Idea: Zygote fungi are named for _____
that produce _____ inside a tough capsule.

A zygosporangium is a _____

The word **identical** means _____

Additional notes about Zygote Fungi: _____

Reading Check: Where does meiosis take place in zygote fungi?

SAC FUNGI

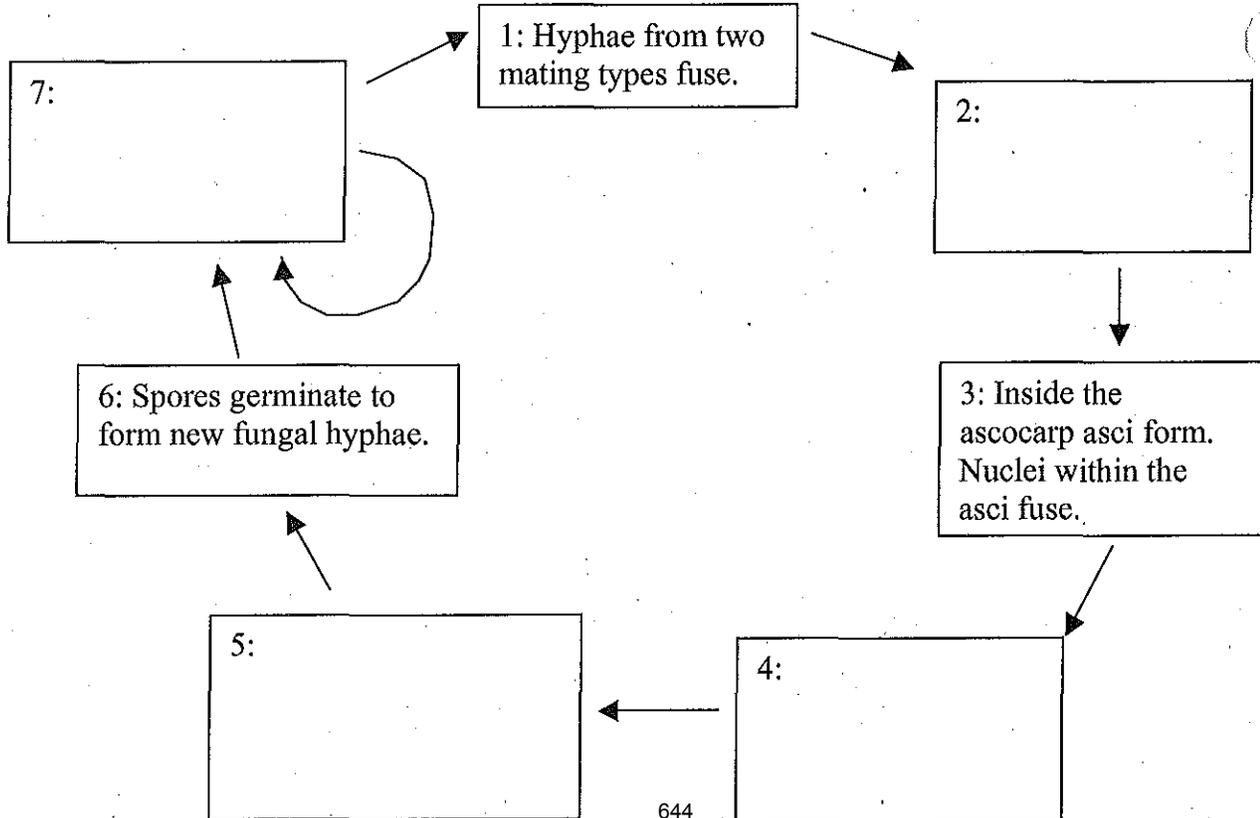
Key Idea: _____ are characterized by an ascus, a _____ that produces spores.

An ascus is _____

Additional notes about Sac Fungi: _____

Reading Check: In sac fungi, which structure is dikaryotic? _____

Fill in the process chart below with the steps of the life cycle of sac fungi. Label the loops for sexual and asexual reproduction.



CLUB FUNGI

Key Idea: Club fungi are characterized by a _____, a clublike sexual reproductive structure that produces spores.

A basidium is _____

Additional notes about Club Fungi: _____

Reading Check: Which part of a club fungus is dikaryotic? _____

FUNGAL PARTNERSHIPS

Key Idea: Fungi form mutualistic symbiotic associations to form _____
and _____.

A lichen is a _____

A mycorrhiza is _____

Additional notes about Fungal Partnerships: _____

Fungi

Section: Fungi and Humans

FUNGI AND INDUSTRY

Key Idea: Fungi are used for _____, _____, _____, _____, and _____.

Additional notes about Fungi and Industry: _____

FUNGI AND THE ECOSYSTEM

Key Idea: Fungi play important ecological roles by _____

Additional notes about Fungi and the Ecosystem: _____

Reading Check: What is the primary role of fungi in ecosystems? _____

FUNGI AND DISEASE

Key Idea: Fungi cause disease by _____ nutrients from host _____ and by _____.

A dermatophyte is _____

Additional notes about Fungal Infections: _____

647

Additional notes about Fungal Toxins: _____

The prefix *histo-* means “a web.” Explain why this prefix might be part of an appropriate name for a fungal disease. _____

Plant Diversity and Life Cycles

Section: Introduction to Plants

WHAT IS A PLANT?

Key Idea: Plants are _____ whose cells have cell walls. Most plants are _____ - they produce their own food through _____.

Additional notes about What is a Plant?: _____

Reading Check: What do plants need for photosynthesis? _____

ESTABLISHMENT OF PLANTS ON LAND

Key Idea: In order to thrive on land, plants had to be able to absorb _____, to _____

_____, and to _____.

A **cuticle** is a _____

A **spore** is a _____

The word **transport** means _____

Additional notes about Absorbing Nutrients: _____

Additional notes about Preventing Water Loss: _____

Additional notes about Dispersal on Land: _____

Reading Check: What is the waxy layer on the aboveground parts of most plants that helps prevent water loss called? _____

PLANT LIFE CYCLES

Key Idea: Plants have life cycles in which _____
alternate with _____. A life cycle in
which a _____ alternates with a
_____ is called _____.

A sporophyte is _____

A gametophyte is _____

Basic Life Cycle of a Plant

Step 1: _____

Step 2: _____

Step 3: _____

Additional notes about Plant Life Cycles: _____

Reading Check: Is a plant sporophyte diploid or haploid? _____

Plant Diversity and Life Cycles

Section: Seedless Plants

NONVASCULAR PLANTS

Key Idea: Nonvascular plants are small plants that reproduce by means of _____, They lack true _____, _____, and _____, which are complex structures that contain vascular, or conducting, tissues.

The word **consist** means _____

Additional notes about Mosses: _____

Additional notes about Liverworts: _____

Additional notes about Hornworts: _____

REPRODUCTION IN NONVASCULAR PLANTS

Key Idea: In the life cycle of nonvascular plants, the _____ is the dominant generation. _____ must be covered by a film of _____ in order for _____ to occur.

An **archegonium** is a _____

An **antheridium** is a _____

A **sporangium** is a _____

Additional notes about Life Cycle of a Moss: _____

Reading Check: Which structure produces male sex cells in nonvascular plants? _____

SEEDLESS VASCULAR PLANTS

Key Idea: _____ of seedless vascular plants have vascular tissue, but _____ lack vascular tissue. Because of their vascular system, vascular plants grow much _____ than nonvascular plants and also develop _____.

A **rhizome** is a _____

A **frond** is the _____

Additional notes about Club Mosses: _____

Additional notes about Ferns and Fern Allies: _____

Reading Check: Where do sporangia form on ferns? _____

What are two types of seedless vascular plants? _____

652 **REPRODUCTION IN SEEDLESS VASCULAR PLANTS**

Key Idea: Like nonvascular plants, seedless vascular plants can reproduce

_____ when a film of water covers the _____.

Unlike nonvascular plants, seedless vascular plants have _____

that are much larger than their _____.

A **sorus** is a _____

Additional notes about Reproduction in Seedless Vascular Plants:

Reading Check: How large is a fern gametophyte? _____

Additional notes about Spores: _____

Reading Check: What is a cluster of sporangia on a fern frond called?

Plant Diversity and Life Cycles

Section: Seed Plants

KINDS OF SEED PLANTS

Key Idea: Seed plants are traditionally classified into two groups -

_____ and _____.

A gymnosperm is _____

A angiosperm is _____

Additional notes about Kinds of Seed Plants: _____

Reading Check: What is the difference between gymnosperms and angiosperms in terms of seed production? _____

REPRODUCTION IN SEED PLANTS

Key Idea: Unlike seedless plants, seed plants do not require _____ to reproduce sexually. Reproduction in seed plants is also characterized by a greatly reduced _____ and a dominant _____.

A ovule is a _____

A seed is a _____

The pollen grain is the _____

Pollination is the _____

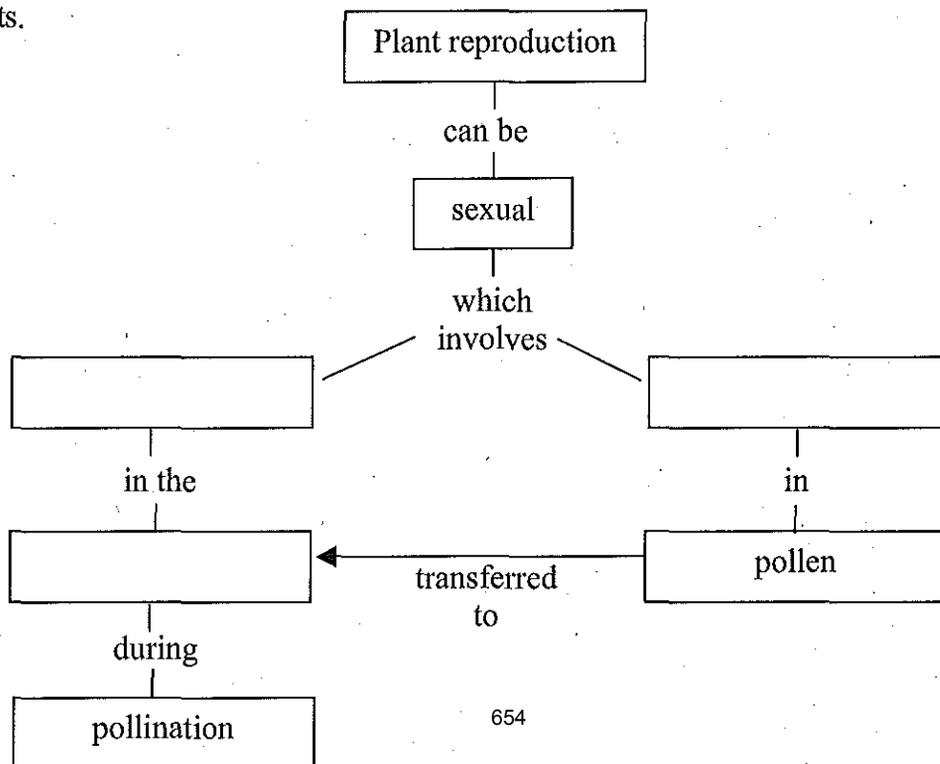
Additional notes about Pollination and Fertilization: _____

Additional notes about Seed Formation: _____

Additional notes about Seed Dispersal: _____

Reading Check: Where do gametophytes develop in seed plants?

Fill in this concept map using what you have learned about reproduction in seed plants.



GYMNOSPERMS

Key Idea: There are four major groups of gymnosperms - _____

Additional notes about Gymnosperms: _____

Reading Check: Which gymnosperm has seeds that do not develop within a cone? _____

LIFE CYCLE OF A CONIFER

Key Idea: Reproduction in conifers is characterized by a dominant

_____, _____, and the

development of _____.

The word **cycle** means _____

Additional notes about Life Cycle of a Conifer: _____

Reading Check: What characteristics of pine seeds aids in dispersal of the seeds? _____

Additional notes about Cones: _____

Reading Check: Are male and female cones always produced on separate plants? _____

Plant Diversity and Life Cycles

Section: Flowering Plants

KINDS OF ANGIOSPERMS

Key Idea: Botanists traditionally divide the angiosperms into two subgroups –

A **monocot** is an _____

A **cotyledon** is _____

A **dicot** is an _____

Additional notes about Kinds of Angiosperms: _____

Reading Check: What are three characteristics of monocots?

REPRODUCTION IN ANGIOSPERMS

Key Idea: A _____ is a specialized reproductive structure of angiosperms. The male and female _____ of angiosperms develop within _____, which promote _____ and _____ more efficiently than do cones.

A **stamen** is _____

An **anther** is _____

657

A pistil is _____

Additional notes about Structure of Flowers: _____

Additional notes about Kinds of Flowers: _____

Reading Check: What is the function of a stamen? _____

Additional notes about Life Cycle of an Angiosperm: _____

Reading Check: What is the function of a pollen tube? _____

POLLINATION

Key Idea: The flowers of many _____ are adapted for
pollination by _____ or by _____.

Additional notes about Life Cycle of an Angiosperm: _____

Reading Check: Name three characteristics of flowers that might attract
pollinators. _____

List two characteristics of insect-pollinated flowers, then list two characteristics
of wind-pollinated flowers. _____

658 **FRUITS**

Key Idea: Although fruits provide some protection for developing seeds, they primarily function in _____.

Fruit is _____

Additional notes about Fruits: _____

Reading Check: From which part of a flower does a fruit develop?

VEGATATIVE REPRODUCTION

Key Idea: Plants reproduce _____ in a variety ways that involve _____ parts, such as _____, _____, and _____. The reproduction of plants from these parts is called _____.

Additional notes about Vegetative Reproduction: _____

Reading Check: What are three types of modified stems by which plants can reproduce vegetatively? _____

Seed Plant Structure and Growth

Section: Plant Tissue Systems

PLANT TISSUES

Key Idea: Vascular plants have three tissue systems – _____

Dermal tissue is _____

Vascular tissue is _____

Ground tissue is _____

Additional notes about Plant Tissues: _____

Reading Check: Where on a plant is dermal tissue found? _____

DERMAL TISSUE SYSTEM

Key Idea: Dermal tissue covers the _____ of a plant's body. In the _____ parts of a plant, dermal tissue forms a "skin" called the _____.

A **stoma** is the _____

A **guard cell** is _____

The word **function** means _____

660

Additional notes about Dermal Tissue System: _____

Reading Check: What is the function of root hairs? _____

VASCULAR TISSUE SYSTEM

Key Idea: Vascular plants have two kinds of vascular tissue, called

_____ and _____, that transport _____,

_____ and _____ throughout the plant.

Xylem is the _____

Phloem is _____

Additional notes about Vascular Tissue System: _____

Reading Check: What are the conducting cells in phloem called?

GROUND TISSUE SYSTEM

Key Idea: Ground tissue makes up much of the _____,

where it _____ and _____ vascular tissue.

Additional notes about Ground Tissue System: _____

Reading Check: What is the primary function of ground tissue in roots and

stems? _____

Seed Plant Structure and Growth

Section: Roots, Stems, and Leaves

ROOTS

Key Idea: Most plants are anchored to the spot where they grow by roots, which absorb _____ and _____.

In many plants, roots also function in the storage of organic _____, such as _____ and _____.

Additional notes about Roots: _____

Reading Check: What are three functions of roots? _____

STEMS

Key Idea: Stems support the leaves and house the _____ tissue, which transports substances between the roots and the _____.

A **vascular bundle** is a _____

A **pith** is the _____

Heartwood is the _____

Sapwood is the _____

Additional notes about Nonwoody Stems: _____

Additional notes about Woody Stems: _____

Reading Check: What is the name of the point where a leaf attaches to a stem?

LEAVES

Key Idea: Leaves are the primary _____ organs of plants.

A **blade** is the _____

A **petiole** is the _____

Mesophyll is _____

The word **source** means _____

Additional notes about Specialized Leaves: _____

Reading Check: What are two types of specialized leaves, and what are their functions? _____

Seed Plant Structure and Growth

Section: Plant Growth and Development

THE PLANT EMBRYO

Key Idea: The plant embryo possesses an embryonic _____
and an embryonic _____. Leaflike structures called
_____, or seed leaves, are attached to the embryonic
_____.

Germination is _____

Additional notes about The Plant Embryo: _____

Reading Check: How many cotyledons does a bean seed have?

Additional notes about Germination: _____

Additional notes about Breaking Dormancy: _____

Reading Check: What are two ways in which the seed coat can be damaged
so that the seed will be able to sprout? _____

Use cause and effect language to describe what happens when water penetrates
a seed coat. _____

664 **MERISTEMS**

Key Idea: Plants grow by producing new _____ in regions of active cell division called _____.

A meristem is a _____

Primary growth is _____

Secondary growth is _____

Additional notes about Meristems: _____

Reading Check: How does primary growth differ from secondary growth?

PRIMARY GROWTH

Key Idea: Primary growth makes a plant's stems and roots get _____ without becoming _____.

Apical meristem is _____

Additional notes about Primary Growth: _____

Reading Check: How many apical meristems does a plant embryo have?

SECONDARY GROWTH

Key Idea: Lateral meristems are responsible for increases in the _____ of stems and roots. This increase is called _____.

Lateral meristem is _____

Additional notes about Secondary Growth: _____

Reading Check: What are the names of the two lateral meristems that are responsible for secondary growth? _____

Plant Processes

Section: Nutrients and Transport

NUTRIENTS

Key Idea: _____, _____, and

_____ do not satisfy all of a plant's need for raw materials.

Plants also require small amounts of _____,

which are elements absorbed mainly as _____.

Additional notes about Nutrients: _____

Reading Check: What two raw materials do plants need to make carbohydrates? _____

TRANSPORT OF WATER

Key Idea: Water and mineral nutrients move up from a plant's roots to its leaves through _____.

Transpiration is _____

Additional notes about Transport of Water: _____

Reading Check: What causes the upward pull on water molecules in xylem? _____

Use spatial language to describe the transport of water through a plant. _____

667

Additional notes about Guard Cells and Transpiration: _____

Reading Check: What happens to the guard cells and stoma when the guard cells take in water? _____

TRANSPORT OF ORGANIC COMPOUNDS

Key Idea: Organic compounds move through a plant within the

_____ from a _____ to a _____.

Steps in the Pressure-Flow Model

Step 1: _____

Step 2: _____

Step 3: _____

Step 4: _____

Additional notes about Pressure-Flow Model: _____

Reading Check: What is an example of a sink? _____

Plant Processes

Section: Plant Responses

PLANT HORMONES

Key Idea: Plant hormones are produced in small amounts but may have large effects on the growth and development of plants. Hormones may

_____ or _____ growth in a plant.

Reading Check: What are two ways in which hormones can affect the growth and development of a plant? _____

Steps in Went's experiment

Step 1: _____

Step 2: _____

Step 3: _____

Step 4: _____

Additional notes about Auxins: _____

Reading Check: What happened to the oat shoot when the agar block with auxin was applied to it? _____

Additional notes about Gibberellins: _____

Additional notes about Cytokinins: _____

Additional notes about Ethylene: _____

Additional notes about Abscisic Acid: _____

Chapter 16 Review

What is a theory?

What does evolution mean in biology?

Who was Darwin? What was his theory?

What is evolution?

What is artificial selection

Darwin's observations of finches indicated descent with _____

According to Malthus, human populations grow in what mathematical way?

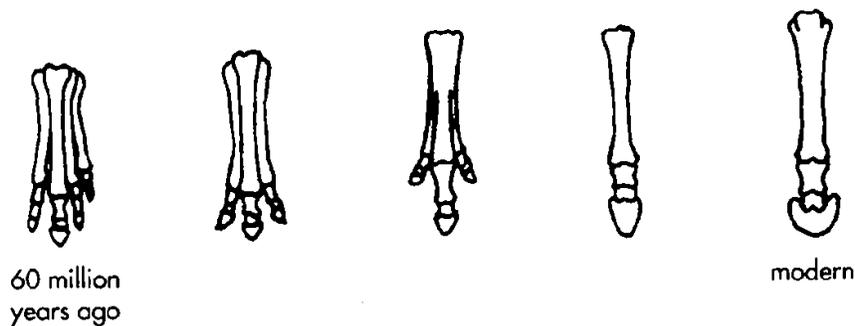
What is overproduction? Selection? Adaptation?

What is natural selection? What are the steps involved?

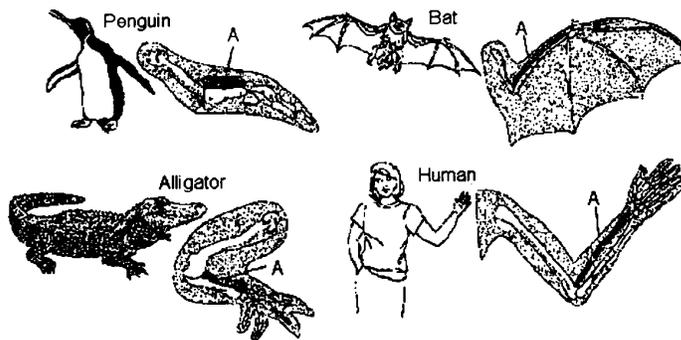
What are the major points of Darwin's view of natural selection?

What is genetic variation in populations? Why are they important?

What is an adaptation? A variation?



What is adaptive radiation? What is punctuated equilibrium?



The similarity of these structures suggests that the organisms _____

Refer to the illustration above. The bones labeled A are known as _____

What are homologous structures? How can you tell they are?

What is the relevance of comparative embryology?

What facts support the theory of evolution?

What is biogeography?

What predictions are made by the modern theory of evolution?

How are darwin's theory of evolution and genetics related? Does one support the other?

What is speciation? What is microevolution? What is macroevolution?

What process is migration and mutation important in?

What is punctuated equilibrium?

What is gradualism in evolution?

1. Genetic variation and change are measured in terms of the frequency of alleles in the _____ of a population.
2. To study genetic variation, what must be counted or estimated in a population?
3. What is macroevolution?
4. What is microevolution?
5. Population genetics involves the study of _____
6. The sum of allele frequencies for any one characteristic in a population is _____
7. What condition absolutely must be present in a population before evolution can act upon it?
8. Why are mutations in body cells not a source of genetic variation?
9. What is the Hardy-Weinberg principle?
10. What causes Hardy-Weinberg principle to not be in proportion?
11. What is gene flow?
12. What is homozygous?
13. What is heterozygous?
14. What happens to a population that inbreeds?
15. What is inbreeding?
16. Which is a probable origin of many recessive genetic disorders?
17. In natural selection, what does the selecting?
18. What is directional selection?
19. What is stabilizing selection?
20. What is disruptive selection?
21. What is directional selection?
22. A population of clams lives in a rocky intertidal zone where black lava has flowed into an area of white sand and bleached coral. The clams' shells range in color from white to black with a shade of gray in between. The white clams and the black clams each outnumber the gray clams ten to one. What type of selection is in effect here?
23. According to the biological species concept, any populations that do not share future offspring are _____
24. When a species begins to occupy more than one niche, and divergence and speciation occur as a result, the species is said to have undergone _____
25. Why is accidental polyploidy in an individual considered a form of reproductive isolation?
26. How can geography lead to reproductive isolation?

27. When a species fails to produce any more descendants, it is said to be

_____.

28. Under which circumstance could a well-adapted species become poorly adapted?

29. Extinction, like speciation, can be detected only after it is _____.

Chapter 19 review

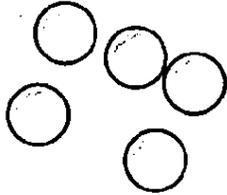
1. What are microspheres?
2. The age of Earth is estimated to be about _____
3. What is relative dating?
4. What is absolute dating?
5. The geologic time scale is based on _____.
6. What do mass extinctions determine ?
7. Cyanobacteria changed the young Earth's atmosphere by producing

8. Pre-eukaryotic cells lacked _____
9. What is endosymbiosis?
10. A layer of ozone in the atmosphere was critical to the formation of life on land because

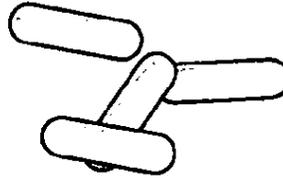
11. The first organisms to populate the surface of the land were _____
12. All of the major phyla of animals on Earth today are _____
13. While there was no soil present, plants were able to invade the surface of the ancient Earth
because they _____
14. The first animals to invade the land were the _____
15. Arthropods were successful first where, then where?
16. Two-thirds of all terrestrial life disappeared in the last mass extinction approximately
_____ years ago

Ch 20 Review

1. Describe the chromosome of a bacteria.
2. Structures found in bacterial cells but not in eukaryotic cells are
3. What are the shapes of these?



Organism A



Organism B



Organism C

4. What are plasmids?
5. What are prions?
6. Cell organelles that *Escherichia coli* and other bacteria have in common with eukaryotes are _____
7. It is important to distinguish between Gram-positive and Gram-negative bacteria in diagnosing a bacterial infection because _____
8. What is the difference between eukaryotic and prokaryotic cell walls?
9. what make up bacterial cell walls?
10. Cyanobacteria are photoautotrophs because they require _____
11. What are nitrogen-fixing bacteria?
12. What is conjugation?
13. What is binary fission?
14. What is a bacterial endospore?
15. Are viruses alive? Why or why not?
16. What are viruses doing in biology?
17. What are the parts of a typical virus?
18. What types of viruses are there?
19. What is an RNA virus?
20. What is a DNA virus?
21. What is a retrovirus?
22. The function of a bacteriophage's tail and tail fibers is to inject _____
23. What is a lytic cycle?
24. What is the lysogenic cycle?
25. What is a virulent virus?

26. The cycle of viral infection, replication, and cell destruction is called the virus's

27. What is a prion?

28. What is Koch's postulate?

Ch 21 Review

1. What type of organisms are in the Kingdom Protista?
2. What things do organisms in Protista have?
3. Eukaryotes that lack the features of animals, plants, or fungi are classified in the kingdom _____
4. What are pseudopodia?
5. What are flagella?
6. If something is unicellular and has a cell wall, what type of reproduction does it use?
7. Amoebas capture food by _____
8. How do diatoms reproduce?
9. What are algae? Where are they found?
10. What are euglenoids? How do they eat?
11. What is conjugation?
12. What is giardiasis?
13. What is Chagas disease?
14. What is amoebic dysentery?
15. What is malaria?
16. What is toxoplasmosis?
17. Protists that play an important role in aquatic food webs are called _____
18. The evolution of the plant kingdom can be inferred by studying _____
19. A mass of cytoplasm that has many nuclei is a(n) _____
20. A protist that almost destroyed the entire potato crop in Ireland in 1846 is a _____
21. When an algal bloom dies, the bacteria that decompose the algae do what to the water?

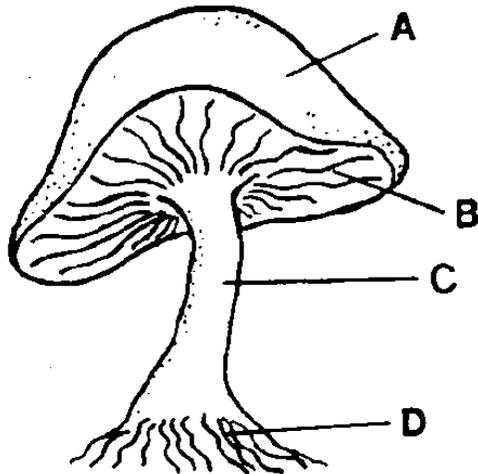
What is chitin?

What are fungi bodies made of?

The individual filaments that make up the body of a fungus are called

What are several types of fungus?

What are the parts of this structure (A-D)



How do fungi obtain food?

How do fungi digest food?

How are fungal spores formed?

The group of fungi that includes the molds that often grow on bread is the _____

What are ascomycetes? How do they reproduce?

Mushrooms, puffballs, and shelf fungi are examples of

In a symbiotic association, such as a lichen, a fungus provides mineral nutrients to a(n)

What are mycorrhizae?

Where do mycorrhizae grow?

What is a lichen?

What human uses are there for fungi?

What role do fungi have in the ecosystem?

The fungi in lichens prepare the environment for the growth of plants by

What ways do fungi cause disease?

What is a dermatophyte?

680 PLANT REVIEW

Most of the energy used by life on Earth comes from the _____

Light energy is converted to chemical energy through the process of _____

As light intensity increases, the rate of photosynthesis _____

Low temperatures may cause photosynthesis to occur _____

Which of the following environmental factors does not affect the rate of photosynthesis? _____

The name of the process that takes place when organic compounds are broken down in the absence of oxygen is _____

Fermentation enables glycolysis to continue under _____

If oxygen is absent during the second stage of cellular respiration, _____

Cells produce ATP most efficiently in the presence of _____

The ancestors of today's land plants were probably _____

The waxy protective covering of a land plant is called a _____

The diploid form in a plant's life cycle is called the _____

The haploid form in a plant's life cycle is called the _____

Fiddleheads are produced by _____

Flowering plants are classified as monocots or dicots according to the number of their _____

The primary function of root hairs is _____

The center region of ground tissue in a herbaceous stem is known as the _____

Leaves connect to the stems of plants at the _____

Plants grow in regions of active cell division called _____

During periods of primary growth at apical meristems, stems and roots do what? _____

what is an autotroph? _____

ATP is composed of a nitrogenous base, a sugar, and _____

ATP is called a cell's energy "currency" because _____

An enzyme that catalyzes the synthesis of ATP is _____

Chlorophyll is green because _____

The major atmospheric by-product of photosynthesis is _____

what has photosynthesis done to the atmosphere? _____

When glycolysis occurs, what happens to glucose? _____

What is the net gain of ATP molecules in glycolysis? _____

Cellular respiration takes place in two stages: _____

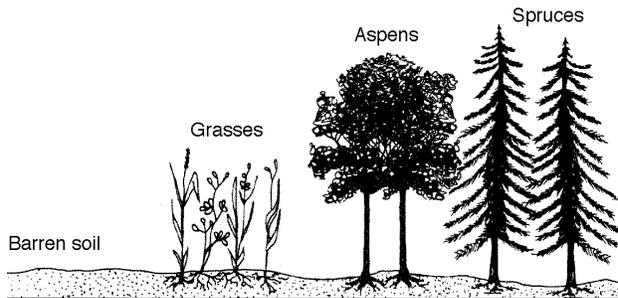
Which process produces the most ATP? _____

If a flower has 9 petals, the leaves will have _____

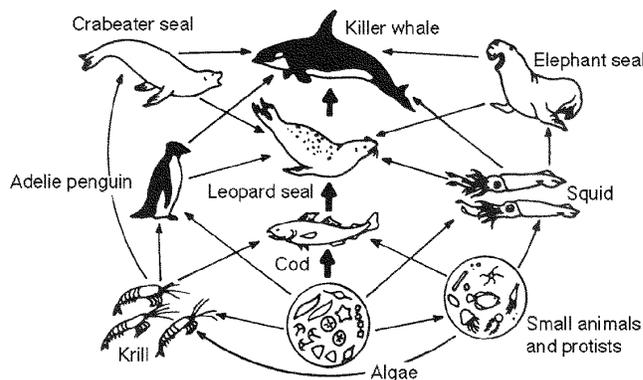
The stomata prevent water vapor and carbon dioxide from entering and leaving the leaf. The size of the stomata are controlled by _____

Ch 4 Review

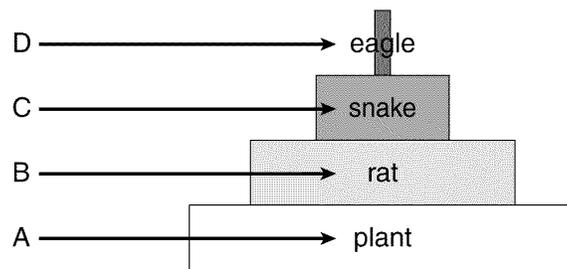
1. A group of organisms of different species living together in a particular place is called a _____
2. What is an ecosystem?
3. What is a population?
4. What is a community?
5. What is a habitat?



6. When the settlers arrived in New England, many forests were turned into fields. Eventually, some fields were abandoned and then grew back into forests. This is best described as _____
7. Which of the following factors is not helpful in defining a biome?
8. Which two key factors determine the climate of a region?
9. In biomes where precipitation is low, most organisms have adaptations to _____
10. At least half of the world's species of land organisms live in a _____
11. Which biome receives the most precipitation on average?
12. An area where fresh water from a river mixes with salt water from an ocean is a(n) _____
13. What organisms are on the first trophic level? Second?
14. What are examples of decomposers?



15. The photosynthetic algae are _____
16. Killer whales feed at the _____

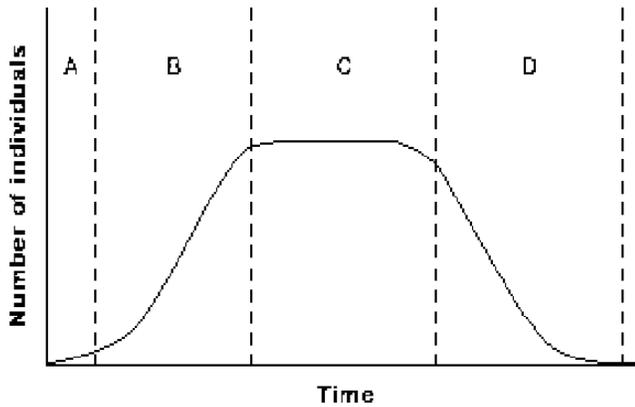


17. How much energy is available to the organisms in level C?
18. Precipitation that percolates into the soil becomes _____
19. All living things are made of _____
20. What are fossil fuels? Where do they come from?
21. What are the parts of the nitrogen cycle?
22. Nitrogen is a component of _____
23. What is the phosphorous cycle?
24. In water, calcium phosphate dissolves to form which substance that is taken up by the roots of plants?
25. Phosphorus is often found in soil and rock in which form?

Ch 5 Review

1. What is a population?
2. Because individuals in a population usually tend to produce more than one offspring, populations _____
3. As a population reaches its carrying capacity, resources become more scarce. What would increase within the population?

Population Growth Over Time

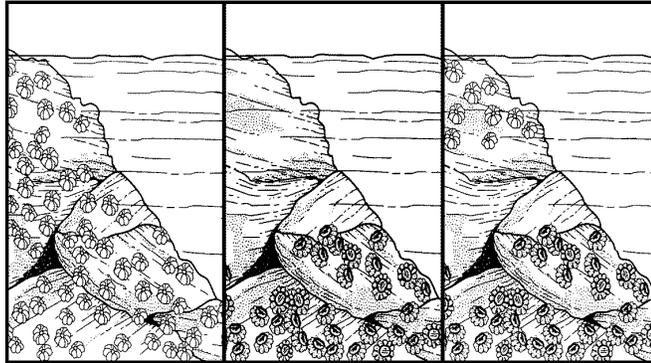


a.

4. Which time period shows exponential growth of the population?
5. During which time period are the birthrate and death rate equal?
6. During which time period will the growth rate of the population be zero?
7. The time period during which the rate of growth of a population would have a negative value is
8. What are abiotic factors that affect population size?
9. Which is a biotic factor that affects population size?
10. As the density of a population increases, the effects of starvation and disease also often increase. These are which kind of factors?
11. The human population began to grow exponentially during the middle of the 1700s due to the _____
12. Vaccines have contributed to human population growth by _____
13. Like parasitism, herbivory does not usually result in the _____
14. What is the predator-prey relationship?
15. Over millions of years, plants and their pollinators have _____

1	Both organisms benefit from their relationship.
2	One organism benefits, and the other organism neither benefits nor suffers harm.
3	One organism obtains its nutrients from another; the other organism may weaken due to deprivation.

16. The table represents three types of _____
17. The relationship that corresponds to description 2 is known as _____
18. What is a niche?
19. What is the trophic level?
20. Which of the following usually results when members of the same species require the same food and space?
21. What usually results when members of the same species require the same food and space?



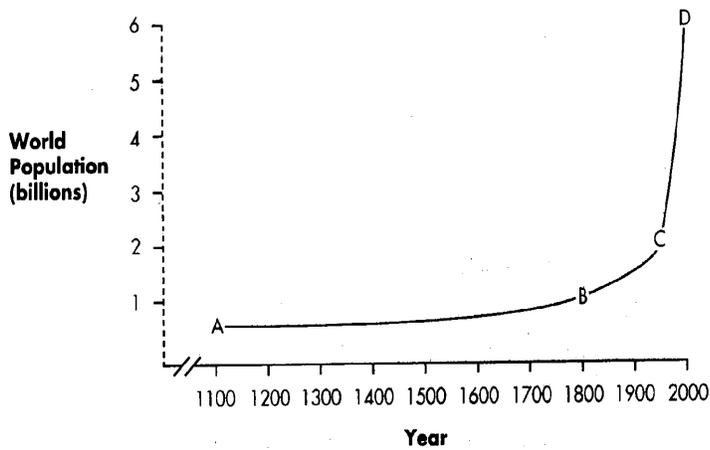
A. The barnacle *Chthamalus stellatus* can live in both shallow and deep water on a rocky coast.

B. The barnacle *Balanus balanoides* prefers to live in deep water.

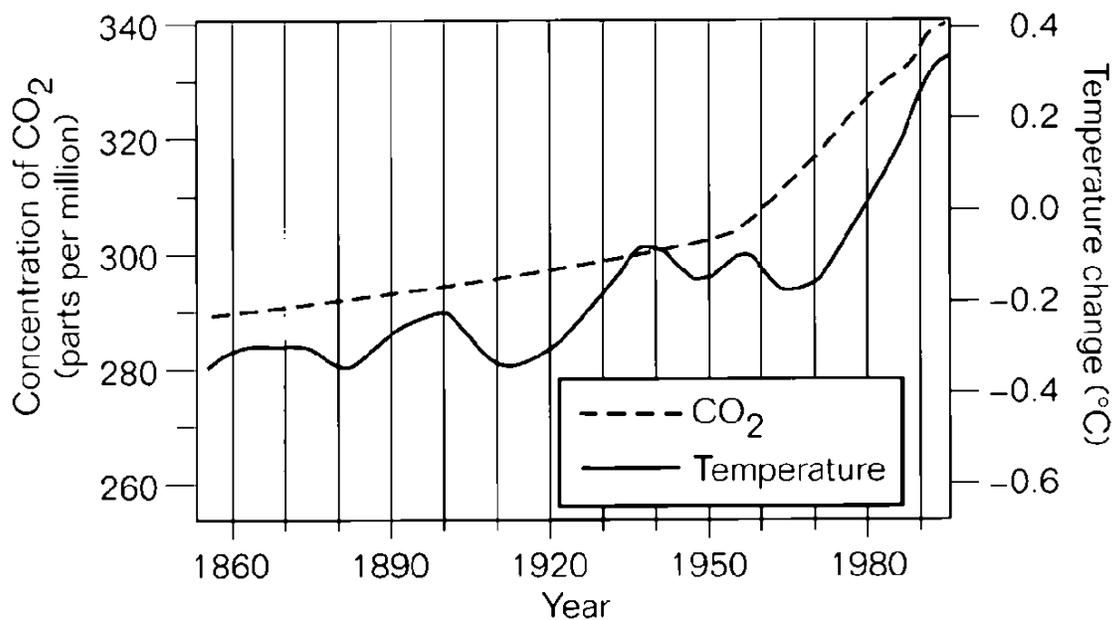
C. When the two live together, *Chthamalus* is restricted to shallow water.

22. Because the two species of barnacles attempt to use the same resources, they are _____
23. What is a competitive niche?
24. What is a realized niche?
25. What is a fundamental niche?
26. If the niches of two organisms overlap, what occurs?
27. Sea stars are fierce competitors of marine organisms such as clams and mussels. An ecologist studying an ocean ecosystem performed an experiment in which the sea stars were removed from the ecosystem. After the removal of the sea stars, what would happen to the ecosystem?

Chapter 6 Review



1. The American Revolution began in 1776. According to the graph, what was the approximate world population at that time?
2. Which letter in the graph indicates the approximate world population in the year 1950?
3. What is a renewable resource?
4. Why is coal a nonrenewable resource?
5. What is a CFC and why are they dangerous?
6. What does ozone in the atmosphere do?
7. What is a product of burning fossil fuels?
8. What are greenhouse gases? What do Greenhouse gases do?
9. What is the Greenhouse Effect?



10. What is this graph showing?
11. What is carbon dioxide levels since 1980
12. What do algal blooms do to fish?
13. Crop rotation helps to conserve fertile soil by
14. What human activities cause an decrease in biodiversity?
15. Why is it important to conserve the tropical rainforest?
16. Draining a pond to remove polluted sediments and then refilling the pond is an example of
17. How can each person reduce resource use?