



Unit 1: Introduction

Chapter 1: Making biology relevant

- Showing prospective employers that you accept responsibility

Chapter 2: The need for scientific reasoning

Chapter 3: Four views of the world

- Viewing the world on a microscopic level
- Viewing the world on an atomic level

Unit 2: What is Life?

Chapter 1: Explaining why things happen

- Possible explanations
- Hypothesis vs. theory
- Proposing a hypothesis
- Hypotheses predict things
- Confirming a hypothesis

Chapter 2: How did the universe begin?

- The Big Bang hypothesis
- Predictions from the Big Bang hypothesis
- Formation of the sun
- Formation of the earth

Chapter 3: The Early Earth

- Origin of water
- The early atmosphere

Chapter 4: The Origin of Life

- The Oparin-Haldane hypothesis
- Predictions from the Oparin-Haldane hypothesis
- Miller and Urey's experiment supporting the Oparin-Haldane hypothesis

Chapter 5: What are the Necessary

Components of Life: What Must Do or Have to Be Considered Alive?

- It must have a waterproof place to construct life
- It must take in energy
- It must take in nutrients
- It must grow
- It must reproduce

- It must respond to changes in its internal environment
- It must adapt to long-term changes in the external environment

Unit 3: The Chemistry of Life

1. Slide Presentation A

Chapter 1: Carbon - the basis of life

Chapter 2: States of Matter

- Why are there solids, liquids, and gases?
- The intermolecular bond
- Polar and nonpolar molecules

Chapter 3: The Intramolecular Bond

- Ionic bond
- Covalent bond
- Polar covalent bond

Chapter 4: The Intermolecular Bond

- The hydrogen bond
- Van der Waals forces

Chapter 5: The Periodic Table

- Electron shells
- Electrons per shell

Chapter 6: Electronegativity

- Chart of electronegativity
- Determining the intramolecular bond from the electronegativity chart
- Hydrocarbons

Chapter 7: Van der Waals Forces

- Increasing the number of van der Waals bonds with longer molecules
- Increasing the number of van der Waals bonds with cooling
- Increasing the number of van der Waals bonds with pressure

Chapter 8: Nonpolar vs. Polar Molecules

- Why water and oil don't mix
- Micelle formation

2. Slide Presentation B

Chapter 9: Mathematics of Chemistry

- Density
- Rounding off
- Reading graphs of water density
- Water temperature in frozen lakes

Chapter 10: Making Nonpolar Molecules Polar

- Attaching polar caps
- Phospholipids
- Replacing one hydrogen atom with an oxygen atom
- Alcohols, aldehydes, ketones, ethers, carboxylic acids, and esters
- Volatility and fragrance
- Weak acids
- Attaching oxygen atoms to each carbon atom

Chapter 11: Carbohydrates

- Monosaccharides
- Polysaccharides
- Oxidation
- Oxidation of hydrocarbons
- Oxidation of carbohydrates

Chapter 12: Proteins

- Amino acids
- Polar and nonpolar amino acids
- Protein folding
- Protein binding site
- Hemoglobin
- Heme and iron
- Collagen
- Lipoproteins
- Enzymes
- Protein denaturation

Chapter 13: Nucleic Acids

- Structure of RNA and DNA
- Nucleic acids
- Ribose and deoxyribose

Unit 4: The Cell Membrane

Chapter 1: Designing a waterproof environment

- Requirement of life for water
- Making a cell membrane waterproof
- Making a waterproof membrane polar
- Lipid bilayer
- Designing a way to allow polar and nonpolar molecules through a membrane

Unit 5: Take in Nutrients

1. Slide Presentation A

Chapter 1: Getting nutrients into the cell

- Why molecules move
- Discovery of Brownian movement
- Hypothesis to explain Brownian movement
- Testing the hypothesis
- Einstein's contribution to understanding Brownian movement
- Bulk movement of solutes
- Diffusion

Chapter 2: Concentration Gradients

- The Law of Entropy
- Concentration gradients
- Reading graphs of solutes diffusing
- Reversing entropy requires energy
- Moving up a concentration gradient
- Concentrating solutes heats up solutes
- Speeding up diffusion: temperature
- Speeding up diffusion: smaller molecules
- Speeding up diffusion: higher concentration?
- Reading graphs of rate of diffusion

Chapter 3: Diffusion Across Cell Membranes

- Diffusion of small molecules: carbon dioxide and water
- Diffusion of ions and polar molecules
- Diffusion of large molecules
- Diffusion of nonpolar molecules

2. Slide Presentation B

Chapter 4: Semipermeable Membranes

- Definition of semipermeable membrane
- Membrane pores
- Transport proteins
- Reading graphs of ionic movement across semipermeable membranes
- Facilitated transport
- Reading graphs of facilitated transport
- Energy requirements for facilitated transport
- Osmosis
- Aquaporin: transport protein for water
- Aquaporin: transport proteins for gases?
- Why transport proteins?
- Maintaining concentration gradients of ions across cell membranes
- Active transport
- Energy requirement for active transport
- Summary of movement across cell membranes

Chapter 5: Equilibrium

- Equilibrium in a one chamber system
- Equilibrium in a two chamber system
- Definition of equilibrium
- Hypertonic, hypotonic, and hypotonic solutions
- Equilibrium between hypertonic and hypotonic solutions
- Movement of water to correct concentration gradients across semipermeable membranes
- Water moves from hypotonic to hypertonic solutions
- Electrochemical gradients
- Active transport to maintain concentration and electrochemical gradients

Chapter 6: Osmosis

- Reducing osmosis by making extracellular and intracellular fluids isotonic
- Sodium-potassium pump
- Red blood cells
- Red blood cells in hypertonic salt solutions: cell crenation
- Red blood cells and hypotonic salt solutions: cell lysis
- Osmotic pressure
- Measuring osmotic pressure
- Reverse osmosis to desalinate water
- Kidney dialysis
- Coma due to excessive water drinking
- Emergency treatment of water overdose
- Osmotic pressure in plants
- Rigid cell walls in plants

Chapter 7: Taking in Water and Nutrients in Bulk

- Pinocytosis
- Phagocytosis

Unit 6: Take in Energy

Chapter 1: ATP

- Chemical structure of ATP
- Sources of energy to generate high energy electrons
 - Sunlight
 - Chemical bonds

Chapter 2: Classification of organisms by energy production

- Traditional classification
 - Autotrophs: photoautotrophs and chemoautotrophs

- Heterotrophs
- Alternative classification
 - Autotrophs
 - Heterotrophs

Chapter 3: Photoautotrophs

- Components of sunlight
- Chlorophyll
- ATP and NADH
- Chloroplasts and thylakoids.
- Photosynthesis
 - Reaction center
 - Electron transport chain
 - Water molecules
 - Producing ATP
 - Producing NADPH
- Making glucose using ATP and NADPH
 - Rubisco
 - The Calvin cycle

Chapter 4: Before photosynthesis

- Chemoautotrophs
- Photoautotrophs
- Cyanobacteria

Chapter 5: Pigments besides chlorophyll

- Chemical structure
- Examples
- Methicillin resistant staphylococcus aureus

Chapter 6: Heterotrophs

- Glycolysis
- Pyruvate dehydrogenase
- Mitochondrial aerobic respiration
- Krebs cycle
- Electron transport chain
- Oxidative phosphorylation
- Chemiosmosis
- Mitochondrial heat generation

Chapter 7: Sources of Acetyl CoA

- Glucose
 - Mobilizing fat for energy
 - Nervous system
 - Endocrine system
- Animal fat vs. plant oils

Chapter 8: Fermentation

- Yeast cells
- Muscles during non-aerobic exercise
- White meat vs. dark meat

Chapter 9: Muscle Fatigue

- Hypotheses
 - Lack of glucose
 - Lack of oxygen
 - Toxic buildup
- Delivery of glucose to muscles
- Delivery of oxygen to muscles
- Removal of pyruvate
- Removal of carbon dioxide

Unit 7: Grow

Chapter 1: Proteins

- Functions of proteins
- Synthesis of proteins
 - The DNA code
 - Reading the DNA code
 - Messenger RNA
 - Ribosomes
 - Transfer RNA
 - Synthesizing a polypeptide

Chapter 2: Regulating protein synthesis

- Genes
- Introns
- Exons

Unit 8: Reproduce

Chapter 1: Cell Cycle

Chapter 2: Chromosome duplication

- P53 protein
- CDK and cyclin
- Helicase
- Primase
- DNA polymerase
- Okazaki fragments
- Chromosomal capping

Chapter 3: Mitosis

- Prophase
- Metaphase
- Anaphase
- Telophase

Chapter 4: Meiosis

- Autologous chromosomes

- Haploid vs. diploid
- Purpose of meiosis
- Mistakes in meiosis
 - Chromosome number abnormalities
 - Translocations

Chapter 5: Comparing Mitosis with Meiosis

- Advantages of mitosis
- Advantages of meiosis
- Disadvantages of mitosis

Chapter 6: Examples of Mitotic Reproduction

- Vegetative Reproduction
- Strawberry plants
- Aspen trees
- Fungi

Chapter 7: Alleles

- Dominant
- Recessive
- Phenotype vs. Genotype
- Punnett squares

Chapter 8: Sex chromosomes

- Barr body
- Calico cat
- Pedigree trees
 - Sex-linked recessive
- Punnett squares

Chapter 9: Blood Cell Types

- Blood types
- Blood transfusions

Unit 9: Respond to Internal Changes (Homeostasis)

Chapter 1: Temperature

- Source of heat
- Monitoring of body temperature
- Response to hypothermia
- Response to hyperthermia
- Danger of hyperthermia
- Cold-blooded animals

Chapter 2: Water, Sodium, Potassium

- Water content of blood
- Monitoring water volume
- Anti-diuretic hormone
- Movement of water in plants

Chapter 3: Oxygen and carbon dioxide

- Lung structure
- Transporting oxygen in the blood
- Removing carbon dioxide by the blood

- Carbonic anhydrase
- Carbonated beverages
- Acidic saliva
- Monitoring carbon dioxide levels in the blood
- Monitoring oxygen levels in the blood
- Control of heart output

Chapter 4: Glucose

- Insulin
- Glucagon

Chapter 5: pH

- Sources of acid
- Removal of acid from the blood by the lungs
- Removal of acid from the blood by the kidneys

Unit 10: Respond to Environmental Changes

Chapter 1: Species

- Hypothesizing the origin of species
- Charles Darwin
- Predictions from Darwin's hypothesis
- Evidence supporting Darwin's hypothesis

Chapter 2: Carbon Dating

Chapter 3: Genetic Diversity

- Surviving in a changing environment
- Ways to increase genetic diversity
 - Sexual reproduction
 - Mutations
- Natural selection
 - Homologous structures
 - Analogous structures
 - Vestigial structures
- Measuring genetic relatedness
- Genetic engineering

Chapter 4: Response to a changing environment

- Adaptations
- Variations
- Speciation
 - Advantages
 - Mechanism

Chapter 5: Relationships Between Organisms

- Symbiosis
 - Commensalism
 - Mutualism
 - Parasitism
- Living Apart
 - Predators
 - Scavengers

Chapter 6: Environmental Terminology

- Population
- Community
- Ecosystem
- Ecology
- Habitat
- Niche
- Competition
- Herbivore
- Carnivore
- Omnivore

Chapter 7: Food

- Chains
- Webs

Chapter 8: Cycles

- Water cycle
- Carbon cycle
- Nitrogen cycle

Unit 11 Designing Experiments

Chapter 1: Hypothesis

- Creating a hypotheses
- Confirming a hypothesis

Chapter 2: General Causation

- Experiment to prove general causation
- Independent vs. dependent variable
- The control group
- Designing the experiment
- Plotting the data

Chapter 3: Specific Causation

- Checking each variable
- Changing the suspected variable

Chapter 4: Mathematics

- Percent increase
- Exponents
- Decimals
- Translating math problems into English
- Fractions
- Percentages
- Decimals
- Converting Units
- Fractions in the numerator
- Dividing two fractions
- Fractions in the denominator
- The metric system