



Unit 1: The Solar System

Chapter 1: Where are we on the earth?

- Where is the equator?
- What continents does the equator run through?

Chapter 2: Why are there four seasons?

- Why does the sun move across the sky?
- The earth's tilt

Chapter 3: The solar system

- The planets

Unit 2: The Atom

Chapter 1: Conceptualizing the atom

- Where does coal come from?
- What do you call the smallest piece of coal that can possibly exist and still be coal?
- Resembling the solar system

Chapter 2: Structure of the atom

- Nucleus
- Electrons
- Shells

Chapter 3: Comparing atoms

- Carbon vs. aluminum
- Size of an atom vs. an atom's weight

Unit 3: Electrons, Protons, and Neutrons

Chapter 1: The electron

- Removing an electron from an atom
- van der Graaf generator
- Allowing electrons to flow into your body

Chapter 2: Properties of electrons

- Electrons have a negative electrical charge on them
- Negatively charged electrons always repel each other
- Why do electrons orbit together instead of repelling each other?

Chapter 3: The nucleus

- Positive charge in the nucleus
- Number of protons equals number of electrons
- Protons, like electrons, repel each other
- Why do protons stay together in the nucleus?
- The "strong force"
- The neutron
- Atoms with different numbers of neutrons in the nucleus are called isotopes.

Unit 4: The Periodic Table

Chapter 1: Organizing all the different atoms

- The periodic table
- Mendeleev
- Hydrogen
- Helium
- Lithium
- The complete periodic table
- The most common atoms in our bodies

Chapter 2: The atomic number

- Atomic number: the number of electrons and protons in each atom
- Carbon

Chapter 3: Structure of the periodic table

- Each horizontal row of the periodic table indicates the number of shells
- Each column indicates the number of electrons in the outermost ring
- What determines atomic size?

Chapter 4: Elements

- Why is each atom called an element?
- Combining elements

Unit 5: The Molecule

Chapter 1: Bonding atoms

- Examples of common molecules
- Everything is made up of single atoms or molecules

Unit 6: The Equal Sharing Bond

Chapter 1: Filling up the outer shell

- In the first shell, up to 2 electrons are allowed to orbit the nucleus
- In the second shell, up to 8 electrons are allowed to orbit the nucleus
- The electrons in shell 2 have more energy than the electrons in shell 1
- Once 8 electrons enter shell 3, the next electron must enter ring 4

Chapter 2: Two hydrogen atoms sharing electrons

- to fill shell 1

Chapter 3: The law of entropy

Chapter 4: The four ways atoms bond to each other

- Equal sharing
- Give and take
- Unequal sharing
- Metallic

Unit 7: Ring 2 of the Periodic Table

Chapter 1: Elements in the second row of the periodic table

Chapter 2: The give-and-take (ionic) bond

- Lithium fluoride

Unit 8: Row 3 of the Periodic Table

Chapter 1: Combining elements in row 3 of the periodic table

Chapter 2: Comparing strength of the ionic bond

Chapter 3: Chemical properties of elements in the same column of the periodic table

Unit 9: Why Atoms Bond

Chapter 1: Creating electrical differences

- Ionic bond
- Covalent bond

Unit 10: States of Matter

Chapter 1: Solids, liquids, and gases

Chapter 2: Crystal lattice

- The formula unit

Chapter 3: The covalent bond

- Electrical neutrality
- Formation of gases

Chapter 3: Partial electrical difference

- Formation of liquids

Chapter 4: Intermolecular vs. intra-molecular bond

- Strength of the intermolecular bond

Unit 11: Crystals

Chapter 1: Breaking intermolecular bonds

- Heat energy
- Mechanical energy

Chapter 2: Cracking a crystal

Chapter 3: Breaking metallic bonds

Unit 12: The Metallic Bond

Chapter 1: Formation of the metallic bond

Chapter 2: Properties of the metallic bond

Chapter 3: Strength of the metallic bond

Chapter 4: Alloys

Unit 13: Transition Metals

Chapter 1: Gold

Chapter 2: Formation of the transition metals

Chapter 3: Properties of transition metals

Unit 14: Heat Conduction

Chapter 1: Heat conduction in metals

Chapter 2: Measuring heat

- Graphing heat and molecular movement

Chapter 3: Scales to measure heat

- Kelvin scale
- Celsius scale
- Fahrenheit scale

Chapter 4: Why metals feel cold

Chapter 5: Heat conduction in alloys

Chapter 6: Chill factor

- Hypothermia

Unit 15: Heat Insulation

Chapter 1: Heat transfer

Chapter 2: Preventing heat transfer

Chapter 3: Examples of insulation

Unit 16: The Polar Covalent Bond

Chapter 1: The water molecule

Chapter 2: Water's intermolecular bond

Unit 17: Properties of Water

Chapter 1: Examples of everyday phenomena

- Rainbows
- Ice expansion
- Ice floating
- Water beading
- Frozen over lakes
- Sweating
- Water and oil
- Soap
- Fire extinguishers
- Salt and ice
- Walking on water
- Steam engines
- Water climbing in trees

Chapter 2: States of water

- Steam
- Water vapor
- Ice

Unit 18: Water Density and Hydraulics

Chapter 1: Determining density

Chapter 2: Ice density

Chapter 3: Water displacement

- Salt water vs. fresh water
- Why ships float
- Why ships sink

Chapter 4: Frozen lakes

- Water temperature beneath the ice
- Salt water density

Chapter 5: Water pressure

- Hydraulic pressure

Unit 19: The Mole

Chapter 1: Lowering the freezing point of water

Chapter 2: Measuring out equal numbers of molecules

- Atomic weight
- Weighted average
- Avogadro's number

Chapter 3: Dissolving solutes in water

Chapter 4: How does salt melt ice?

Unit 20: Ocean Circulation

Chapter 1: Ice is pure water

Chapter 2: North Atlantic ice caps

- The engine for ocean circulation
- How Europe stays warm

Chapter 3: Global warming and ocean circulation

Unit 21: Air Pressure

Chapter 1: Why does water boil?

- Why 212 degrees Fahrenheit?
- Air pressure
- Effect of air pressure on boiling point

Chapter 2: Measuring altitude with air pressure

- The aneroid barometer

Chapter 3: Air temperature at high elevations

- The difference between temperature and heat
- The temperature of outer space

Unit 22: Why Airplanes Fly

Chapter 1: Airplane wing

- Design of the Wright Brothers' airplane
- Lowering air pressure by raising air pressure below the wing
- Why pilots lower the flaps when coming in for a landing

Chapter 2: Sails

- Why baseballs curve downward
- Why golf balls have dimples

Chapter 3: Reducing air pressure in a pipe

- Chimney
- Carburetor
- Perfume bottles
- Prairie dog burrows

Unit 23: Evaporation and Steam

Chapter 1: Absorption of heat by water

- Water as a fire extinguisher
- Sweating
- Wet bulb – dry bulb measure of humidity

Chapter 2: The power of steam

- Steam locomotives
- Underground geysers
- Geothermal energy

Chapter 3: Geology

- Tectonic plates
- Formation of the Himalayan Mountain Range
- The Pacific and North American plates

Unit 24: Humidity, Dew Point, Saturation Water

- Vapor Density

Chapter 1: Water vapor

- Saturation limit

Chapter 2: Measuring humidity

- Graphing humidity versus temperature
- Saturation water vapor density
- Humidity vs. relative humidity
- The dew point

Chapter 3: Coriolis effect

Unit 25: Weather

Chapter 1: The weather map

- Low pressure
- High pressure

Chapter 2: Storm formation

Chapter 3: Formation of a hurricane

Unit 26: Properties of Water

Chapter 1: Surface tension

- Water droplets
- Gerris bug

Chapter 2: Hydrogen bonding

Chapter 3: van der Waals forces

- Making gases into liquids

Chapter 4: The carbon-hydrogen bond

- Electronegativity of atoms

Chapter 5: Making gases into liquids

Chapter 6: Mixing polar and non-polar molecules

Unit 27: Summation

Chapter 1: The four types of intramolecular bonds

- Give-and-take (ionic)
- Equal sharing (covalent)
- Unequal sharing (polar covalent)
- Metallic

Chapter 2: The intermolecular bonds

- Polar vs. nonpolar molecules
- Hydrogen bonding
- Van der Waals bonding

Unit 28: Creating a Living Cell

Chapter 1: Carbon as the building block

Chapter 2: The four types of biologic molecules

- Lipids for cell walls
- Carbohydrates for energy
- Proteins for growth
- DNA to coordinate

Chapter 3: Lipids

Chapter 4: Carbohydrates

- Alcohols
- Aldehydes
- Ketones
- Ethers
- Carboxylic acids
- Esters

Unit 29: Acids, Carbohydrates, and Proteins

Chapter 1: What are acids?

Chapter 2: The mathematics of pH

Chapter 3: Carbohydrates

- ATP
- Carbohydrates as fuel

Chapter 4: Proteins

Unit 30: Nucleic Acids, Energy Production

Chapter 1: RNA

Chapter 2: DNA

- RNA polymerase
- Messenger RNA
- Transfer RNA

Chapter 3: Mitochondria

- Krebs' cycle
- Electron transport chain

Chapter 4: Chloroplasts

- Photosynthesis

Chapter 5: Lipids as energy source

- Fats vs. oils
- Saturated fats vs. unsaturated fats
- Trans vs. cis fatty acids

Unit 31: Electromagnetic Radiation

Chapter 1: The Photon

- Electrical and magnetic components

Chapter 2: Spectrum of Electromagnetic Radiation

- Color
- Why are metals shiny?
- Why are objects black?
- Why are objects transparent?

Chapter 3: Bending light rays

- Passing through water

Unit 32: Electricity

Chapter 1: Movement of electrons

Chapter 2: Static electricity

Chapter 3: Electricity and magnetism

Chapter 4: Making an electric motor

Chapter 5: Making an electrical generator

Unit 33: Nuclear Energy

Chapter 1: Nuclear fusion

- Nuclear fusion on the sun

Chapter 2: Mass and energy

Chapter 3: Life and death of stars

Chapter 4: Nuclear fission

Chapter 5: Dangers of radiation

Unit 34: Introductory Math

Chapter 1: Significant Digits

Chapter 2: Rounding Off

Chapter 3: Logs and Decimals

Chapter 4: Fractions

Chapter 5: Converting Units

Unit 35: I Know – Therefore Statements

Chapter 1: Problems

Chapter 2: Converting units

Chapter 3: Terminology

Chapter 4: Metric system

Unit 36: Chemical Reactions

Chapter 1: Definitions

Chapter 2: Catalysts

Chapter 3: Balancing chemical equations

Unit 37: Gases, Equilibrium

Chapter 1: Coulomb's law

Chapter 2: Ideal gas law

Chapter 3: Solving gas problems

Chapter 4: Electrolysis

Chapter 5: Equilibrium of a chemical reaction

- LeChatelier's principle
- Equilibrium constant
- Solubility product constant
- Equilibrium state
- Phase diagrams

Unit 38: Solutions

Chapter 1: Terminology

Chapter 2: Molarity problems

Chapter 3: Mixtures

- Suspensions
- Colloids
- Emulsions

Chapter 4: Colligative properties

Chapter 5: Acids

- Arrhenius acid
- Bronsted acid
- Lowry acid
- Lewis acid

Unit 39: Nuclear Forces

Chapter 1: Nuclear strong force

Chapter 2: Binding energies

Chapter 3: Nuclear decay

Chapter 4: Half lives

Chapter 5: Carbon dating

Unit 40: Electrolytes

Chapter 1: Oxidation state

Chapter 2: Measuring an atom's attraction to electrons

- Electronegativity
- Electron affinity
- Ionization energy
- Reduction potential

Chapter 3: Voltage potential differences

Chapter 4: Voltage and current

Chapter 5: Electroplating

Chapter 6: Oxidation and reduction

Unit 41: Polymers

Chapter 1: Bakelite

Chapter 2: Polyethylene

Chapter 3: Polypeptides

Unit 42: Orbitals

Chapter 1: Orbitals

Chapter 2: Energy levels

Chapter 3: Hund's rule

Chapter 4: Ionizing energies

Chapter 5: Hybrids

Chapter 6: VESPR