



# Exploring STEM Digital Library

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# Exploring STEM

## Exploring STEM Digital Library: Courses

### STEM INQUIRY

Scientific Investigation and Reasoning
Earth and Space Sciences
Physical Science
Life Science
Scientific Processes
Earth Systems
Matter
Forces and Motion
Energy
Electricity and Magnetism
Waves
Nuclear Physics
Chemical Structure and Bonding
Chemical Reactions
Anatomy
Evolution and Genetics
Biochemistry and Cell Biology
The Living World

### STEM DESIGN

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# STEM Inquiry

## LIB 2: 01 Scientific Investigation and Reasoning

### Scientific Method

- The Scientific Method
- Design and Problem Solving
- Planning Comparative Investigations (Mass of Metals and Non-metals)
- Planning a Descriptive Investigation (Transport Popularity)
- Implement a Comparative Investigation (Density of Metals and Non-metals)
- Designing Experimental Investigations (Energy in Food)
- Implement an Experimental Investigation (Energy in Food)
- Analyze, Evaluate, and Critique Scientific Explanations
- Planning Comparative Investigations (Cooking Potatoes and Pizzas)
- Planning Descriptive Investigations (School Yard Habitat)
- Implement a Comparative Investigation (Heating Oil and Water)
- Implement a Descriptive Investigation (School Yard Habitat)
- Designing Experimental Investigations
- Implement an Experimental Investigation (Photosynthesis)
- Analyze, Evaluate, and Critique Scientific Explanations (Photosynthesis)
- Planning Comparative Investigations (Moon Phases)
- Planning Descriptive Investigations (Navigable River Courses)
- Implement a Comparative Investigation (Planet Distance and Orbit Time)
- Implement a Descriptive Investigation (Rock Sample Features)
- Designing Experimental Investigations (Rock Erosion)
- Implement an Experimental Investigation (Plant Growth and Conditions)
- Analyze and Evaluate Scientific Explanations (Dinosaur Extinction)
- Critique Scientific Explanations

### Safety

- Laboratory Safety 1
- Field Safety 1
- Safety Equipment 1
- Laboratory Safety 2
- Field Safety 2
- Laboratory Safety 3
- Field Safety 3
- Safety Equipment 2

### Using Equipment

- Introduction to the Microscope
- Introduction to the Microscope (Movement of a Slide)
- Using a Microscope

### Data and its Uses

- Viewing Osmosis in Onion Cells
- Collect, Organize, and Analyze Data

### Science and Society

- History of Energy Use
- Scientific Thoughts on Evolution
- History of Astronomy

### Sustainability

- Conservation, Disposal, and Recycling 1
- Conservation, Disposal, and Recycling 2
- Conservation, Disposal, and Recycling 3

## LIB 2: 02 Earth and Space Sciences

### Weather and Climate

- Weather and Air Masses
- Global Wind Patterns
- Climate Change
- Weather Systems
- Weather Maps
- Measuring Weather

### Earth Systems

- Geological Time
- The Changing Earth
- Plate Tectonic Theory
- The Rock Cycle
- Distribution of Natural Resources
- Natural Hazards
- Humans and Ecosystems
- Rock Types
- Soil Composition
- Oil Pollution
- The Water Cycle
- Earth's Atmosphere
- Clouds
- Impact of the Sun's Energy
- Earth Model
- Rocks
- Plate Tectonics
- Natural Catastrophes
- Analyzing Landscapes
- Ground and Surface Water
- Surface Water Modeling
- Plate Tectonic Theory
- Formation of Crustal Features
- Analyzing Maps
- Weathering and Erosion

### Sun, Earth and Moon Interaction

- Earth Cycles
- Seasons
- Lunar Cycles
- Moon and Tides

### Solar System

- The Solar System
- Galilean Moons
- Asteroids, Comets, and Meteors
- Gravity
- Space Travel Equipment
- Space Exploration
- Life in the Solar System
- Living in Space

### The Universe

- Stars
- Classifying Stars
- Wonders of the Universe
- Astronomy
- Origin of the Universe

## LIB 2: 03 Physical Science

### Changing Materials

- Chemical Change

### Properties of Matter

- States of Matter
- Physical Properties of Matter
- Physical and Chemical Changes
- Mixtures
- Metals, Non-Metals and Metalloids
- Density
- Testing Minerals

### Structure of Matter

- Elements
- Elements and Compounds
- Modeling Molecules
- Synthetic Materials
- Particle Model of Matter

### Atomic Structure

- Structure of Atoms

### Periodic Table

- Elements and the Periodic Table

### Chemical Reactions

- Chemical Reactions
- Compounds
- Heat from Reactions

### Structure, Bonding and Reactivity

- Properties of an Atom
- Investigating the Reactivity Series for Five Metals

### Chemical Equations

- Formulas and Equations

### Energy in Chemical Reactions

- Chemical Energy

### Carbon and its Compounds

- Organics Compounds

### Forces and Motion

- Effects of Force
- Friction
- Unbalanced Forces
- Speed and Velocity
- Speed, Velocity and Acceleration
- Newton's Laws of Motion
- Newton's First Law of Motion
- Force and Acceleration
- Collisions
- Velocity and Acceleration
- Simple Machines
- Force and Work

### Energy

- Temperature and Heat
- Energy
- Energy Transformations
- Fossil Fuels
- Generating Energy
- Nuclear Power
- Solar Power
- Biomass Power
- Wind Power
- Hydroelectric Power
- Geothermal Power
- Generating Energy
- Alternative Energy Solution
- Potential and Kinetic Energy
- Transfer of Thermal Energy

### Light

- Shadows
- Color

### Waves and Vibrations

- Wave Properties
- Mechanical Waves

### Digital Technology

- Digital Communication

## LIB 2: 04 Life Science

### Biological Systems

- Response to Stimuli
- Human Body Systems
- Human Circulatory System
- Organization of Biological Systems

### Organism Structure and Function

- The Human Body

### Plant Biology

- Photosynthesis
- Testing Leaves for Starch
- Force in Plants

### Cell Biology

- Types of Cells
- Structure and Function of Cells
- The Cell Theory

### Basic Needs

- Characteristics of Living Things
- Characteristics of Living Things (Physiological Needs)
- Characteristics of Living Things (Life Processes)

### Food and Diet

- Diet

### Energy and Living Things

- Digestion
- Energy in Organisms

### Reproductions

- Reproduction Strategies
- Nature and Nurture
- Reproduction
- Reproduction (Asexual Reproduction and Sexual Reproduction)

### Genetics

- Hereditary Traits 1
- Hereditary Traits 2
- Hereditary Traits 3
- Inheritance
- Genetics
- Changes in Genes
- Genetic Engineering

### Ecosystems

- Ecosystems
- Habitats and Ecosystems
- Biodiversity and Ecosystems
- Ecological Succession
- Cycling of Matter
- Energy Flow
- Food Webs
- Biotic and Abiotic Factors of Ecosystems
- Environmental Change
- Ocean Systems
- Changing Ecosystems
- Ecosystems and Habitats
- Producers, Consumers, and Decomposers
- Ecosystems and Populations

### Population and Biodiversity

- Identifying Organisms
- Populations and Resources
- Maintaining Biodiversity
- Biological Diversity

### Taxonomy

- Classification

### Adaptation

- Biological Adaptations
- Biological Adaptation
- Looking at Adaptations
- Physiological Needs

## Extinction

- Extinction

## Health and Disease

- Exercise
- Health

## Evolution

- Evidence from the Fossil Record
- Evidence for Evolution
- How Natural Selection Works
- Exploring how Organisms have Adapted
- How Species Develop

# LIB 2: 05 Scientific Processes

## Safety

- Laboratory Safety
- Laboratory Safety (Chemistry)
- Laboratory Safety (Physics)
- Field Safety
- Field Safety (Biology)
- Field Safety (Physics)
- Material Safety Data Sheets (MSDS)

## Using Equipment

- Using a Microscope
- Clamps

## Scientific Method

- Definition of Science
- Planning Descriptive Investigations
- Plan a Comparative Investigation (Photosynthesis)
- Implement a Descriptive Investigation (Abiotic and Biotic Features)
- Implement a Comparative Investigation (Photosynthesis)
- Plan an Experimental Investigation (Photosynthesis)
- Implement an Experimental Investigation (Photosynthesis)
- Analysis of Scientific Explanations 1
- Analysis of Scientific Explanations 2
- Evaluation of Scientific Explanations 1
- Evaluation of Scientific Explanations 2
- Scientific Theories
- Planning Investigations
- Implementing Investigative Procedures
- Communicate Valid Conclusions
- Critique Scientific Explanations

## Data and its Uses

- Collect and Organize Data
- Making Measurements with Accuracy and Precision
- Exploring Scientific Data
- Accuracy and Precision
- Dimensional Analysis
- Scientific Notation 1
- Scientific Notation 2
- Significant Figures
- Analyzing Data
- Data Acquisition Probes
- Graphing
- Measuring with Calipers and Micrometers
- SI Units
- Uncertainties in Measured Data
- Organizing and Evaluating Scientific Data
- Communicate Valid Conclusions
- Express Relationships Among Physical Variables

## Science and Society

- History of Science
- Models in Biology
- Contributions of Scientists
- Impact of Scientific Research on Society
- Impact of Scientific Research on the Environment
- Chemistry and Future Careers
- History of Chemistry
- Physics and Future Careers
- Communicating Scientific Information
- Inferences from Promotional Materials

## LIB 2: 06 Earth Systems

### Earth Systems

- Earth's Early History
- Earth Systems
- The Interior of the Earth
- Life and the Earth - Co-evolution
- Earth's Energy Balance
- Water and Earth

### Weather and Climate

- Analyzing Climate Change Data
- Earth's Changing Climate

### Human Sustainability

- Managing Energy and Mineral Resources
- Modeling Resource Relationships
- Reducing Impacts on Natural Systems
- Human Impacts on Earth System Relationships

### Solar Systems

- The Sun
- Orbits and Gravity

## LIB 2: 07 Matter

### Properties of Matter

- Physical and Chemical Changes
- Properties of Matter
- Intensive and Extensive Properties
- States of Matter 1
- States of Matter 2
- Mixtures
- Physical Properties of Matter
- Forces of Attraction Between Particles
- Molecules and Chemical Properties
- Physical and Chemical Properties of Elements and Compounds
- Chemical Reactions and Valence Electrons

### Matter and Change

- The Science of Chemistry

### Fluids

- Surface Tension
- Viscosity in Fluids
- Pressure in Fluids
- Fluid Properties

### Measurement Errors

- Measuring (Measurement Errors)
- Measuring (Manufacturing Tolerance of a Wooden Block)
- Measuring

### Density

- Density (Solids)
- Density (Liquids)
- Density

### Solubility

- Role of Water in Biology and Chemistry
- Solubility
- Factors Affecting Solubility and Rates of Dissolution
- Solutions
- Factors Affecting Solubility
- Solubility in Water (Soluble or Insoluble in Water)
- Solubility in Water (Effect of Temperature on the Solubility of a Solid)
- Solubility in Water

### Gas Laws

- Boyle's Law
- Charles' Law
- Avogadro and the Gas Laws
- Dalton's Law of Partial Pressures
- Ideal Gas Equation
- Gas Laws Calculations
- Kinetic Molecular Theory



## LIB 2: 08 Forces and Motion

### Types of Forces

- Forces Acting at a Distance
- Magnetic and Electrical Forces
- History of Electromagnetic Forces
- Electric Forces
- Electric and Magnetic Forces in Everyday Life

### Measurement of Force

- Triple Beam Balance
- Spring Scales

### Force and Deformation

- Springs
- Elasticity

### Describing Movement

- Describe and Calculate Motion
- Distance and Speed
- Forces and Motion
- Vectors
- Types of Motion
- Motion Charts and Graphs
- Speed and Velocity
- Relative Motion

### Force and Acceleration

- Force, Mass, and Acceleration
- Acceleration
- Design a Force-Mass-Acceleration Investigation
- Implement a Force-Mass-Acceleration Investigation
- Investigating the Relationship between Force and Acceleration
- Evaluate Data from a Force-Mass-Acceleration Investigation
- Circular Motion
- Forces and the Laws of Motion

### Gravity

- Force Due to Gravity
- Theory of Gravity
- Measuring the Acceleration due to Gravity

### Moment of a Force

- Moments and Levers

### Momentum

- Conservation of Momentum
- Force and Momentum
- Momentum and Impulse 1
- Using a Ballistic Cart
- Momentum and Impulse 2

### Pendulums

- Pendulums
- Pendulums (Mass and Period Time)
- Pendulums (Length and Period Time)

### Components of Force

- Free-Body Force Diagrams
- Free-Body Force Diagrams (Force and Slope Angle)
- Free-Body Force Diagrams (Forces Acting at a Single Point)

### Projectiles

- Projectiles
- Trajectory Apparatus

## LIB 2: 09 Energy

### Forms of Energy

- Forms of Energy
- Generating Energy
- Advantages and Disadvantages of Energy Sources
- Social and Environmental Impacts of Energy Sources

### Electrical Energy

- Energy Transfer in Electrical Circuits
- Transfer of Electrical Energy in Conductors

### Heat Energy

- Conduction of Thermal Energy
- Radiation of Thermal Energy
- Convection of Thermal Energy
- Temperature and Heat
- Heat Transfer
- Thermodynamic Laws
- Heat Transfer
- Heat from Reactions
- Heat Calculations

### Work, Force and Energy

- Kinetic and Potential Energy 1
- Kinetic and Potential Energy 2
- Work-Energy Theorem
- Power and Mechanical Energy
- Efficiency of an Electro-mechanical System

### Conservation of Energy

- Law of Conservation of Energy
- Conservation of Energy

## LIB 2: 10 Electricity and Magnetism

### Static Electricity

- Electrostatics
- Static Electricity

### Magnetism

- Magnetism (Bar Magnets)
- Magnetism (Magnetic Field Around a Bar Magnet)
- Magnetism (Magnetic Field Around an Electromagnet)

### Electromagnetism

- Electromagnetism
- Applications of Electromagnetism

### Electrical Circuits

- Building and Testing Circuits
- Resistors
- Electrical Conductors and Insulators
- Series Circuits
- Parallel Circuits
- Series Circuit Calculations
- Parallel Circuit Calculations
- Electrical Conductivity
- Electrical Components
- Series and Parallel Circuits (Current)
- Series and Parallel Circuits (Potential Difference)
- Series and Parallel Circuits

## LIB 2: 11 Waves

### Waves and Vibrations

- Wave Motion
- Electromagnetic Spectrum Charts
- Polarization
- Oscillations
- Wave Properties
- Transverse and Longitudinal Wave Characteristics
- Resonance
- Doppler Effect
- Applications of Waves
- Sound Waves (Vibrating Air and Vibrating String)
- Sound Waves (Doppler Effect)
- Sound Waves
- Propagation of Sound (Speed of Sound in Air)
- Propagation of Sound (Transverse and Longitudinal Waves)
- Propagation of Sound
- Light Intensity on a Solar Panel
- Natural Frequency
- Light Levels
- Acoustic Waves
- Seismic Waves
- Light Waves
- Water Waves

### Optics

- Laser Pointers
- Refraction - Prism
- Refraction - Convex Lens
- Diffraction
- Interference
- Reflection
- Light Rays (Refractive Index and Critical Angle of Internal Reflection)
- Light Rays (Law of Reflection)
- Light Rays (Convergence and Divergence)
- Light Rays

### Electromagnetic Spectrum

- Electromagnetic Radiation

### Digital Technology

- Digital Information

## LIB 2: 12 Nuclear Physics

### Atomic and Nuclear

- Emission Spectra
- Periodic Table
- Equipment Used in Atomic Physics Experiments
- History of Nuclear Force Concepts
- Nuclear Forces
- Origins of Quantum Theory
- Mass Energy Equivalence
- Applications of Nuclear Physics
- Applications of Quantum Physics
- Quantum Mechanical Model of the Atom

### Radioactivity

- Discovery of Radioactivity
- Nuclear Equations
- Fission and Fusion

## LIB 2: 13 Chemical Structure and Bonding

### Periodic Table

- Periodic Table and Properties of Elements
- Development of the Periodic Table
- Chemical Families
- Noble Gases
- Alkali Metals
- Alkaline Earth Metals
- Halogens
- Transition Metals
- Identifying Trends in the Periodic Table
- Physical Trends in the Periodic Table

### Atomic Structure

- Dalton's Atomic Theory
- Thomson and the Properties of the Electron
- Rutherford's Nuclear Atom
- Bohr's Nuclear Atom
- Waves and Spectra
- Isotopes and Atomic Mass
- Electron Configuration

### Chemical Bonding

- Intermolecular Bonding
- Intra-molecular Bonding (RasMol Molecular Viewer)
- Intra-molecular Bonding (Ionic and Covalent Bonded Substances)
- Intermolecular and Intra-molecular Bonding
- Electron Dot Formulas
- Metallic Bonding
- Molecular Geometry

### Carbon and its Compounds

- The Importance of Carbon
- Organic Compounds
- Origin and Properties of Oil
- Processing and Uses of Oil
- IUPAC Nomenclature Rules for Organic Compounds
- Writing Formulas from the Chemical Name
- Physical Properties of Organic Compounds
- Uses of Organic Compounds
- Synthetic Polymers
- Carbohydrates
- Proteins
- Combustion of Hydrocarbons
- Papermaking
- Fermentation

## LIB 2: 14 Chemical Reactions

### Changing Materials

- Separating Mixtures
- Evaporation
- Evaporation (Separating Sodium Chloride from a Sodium Chloride Solution)
- Evaporation (Evaporation Rate of a Liquid)
- Purification
- Distillation
- Chromatography
- Dispersive Liquids

### Types of Reaction

- Chemical Decomposition
- Decomposition (Catalytic Decomposition of Hydrogen Peroxide)
- Decomposition (Thermal Decomposition of Different Copper Salts)
- Redox 1
- Redox 2

## Acids and Bases

- Acids and Bases
- pH Scale
- Types of Reaction
- Strong and Weak Acids and Bases
- pH Scale
- pH Scale (Universal Indicator Solution)
- pH Scale (Universal Indicator Paper)
- Acid Rain
- Acid Rain (Buffering Properties of Soil Samples)
- Acid Rain (Reaction of Metals Exposed to Acid Rain)

## Ions

- Salts
- Atomic Structure and Ions

## Chemical Formulas

- Nomenclature Rules
- Writing Chemical Formulas

## Energy in Chemical Reactions

- Energy Changes in Chemical Reactions
- Enthalpy

## Rates of Reaction

- Rates of Reaction
- Chemical Equilibrium
- Reactivity
- Reactivity (Metal Reactivity Series)
- Reactivity (Reactivity Series of Three Halogens)

## Electro-chemistry

- Conductivity
- Electrolysis of Liquids
- Electro-chemistry
- Electro-chemistry (Electrolysis of Water)
- Electrolysis of Liquids (Copper(II) Sulphate Solution)
- Electrolysis of Liquids (Potassium Salt Solutions)
- Batteries and Cells

## Stoichiometry

- Moles
- Empirical and Molecular Formulas
- Balancing Equations
- Stoichiometric Calculations 1
- Stoichiometric Calculations 2
- Perform Stoichiometric Calculations
- Conservation of Mass
- Titration
- Stoichiometry (Sodium Hydrogen Carbonate)
- Stoichiometry (Iron Powder and Copper(II) Sulphate Solution)
- Stoichiometry
- Advanced Stoichiometry
- Advanced Stoichiometry (Hydrated Copper(II) Sulphate Crystals)
- Advanced Stoichiometry (Calcium Carbonate and Hydrochloric Acid)
- Advanced Stoichiometry 1
- Advanced Stoichiometry 2

# LIB 2: 15 Anatomy

## Biological Systems

- Regulatory Systems in Animals
- Nutrient Absorption in Animals
- Reproductive Systems in Animals
- Defense Systems in Animals
- Organization of Biological Systems
- Body Feedback Mechanisms
- Organism Response

## The Eye

- Lenses
- Structure of the Eye
- Defects of Vision

## Anatomy and Health

- The Natural History of Disease
- The Digestive System and Health
- The Respiratory System and Health
- The Human Respiratory System
- The Circulatory System and Health
- The Human Circulatory System
- The Excretory System
- The Excretory System and Health
- The Nervous System and Health
- The Endocrine System
- The Endocrine System and Health
- The Reproductive System and Health
- Voluntary Muscles
- The Musculoskeletal System and Health
- Bones
- Joints
- Decalcified and Calcined Bones
- The Integumentary System
- The Integumentary System and Health

## Exercise

- Effects of Exercise

## Food and Diet

- Human Digestive System
- Diet
- Starch in Food
- Sugar in Food
- Sugar in Food (Reducing and Non-reducing Sugars)
- Sugar in Food (Identifying Sugars in Food)
- Protein in Food
- Fat in Food

# LIB 2: 16 Evolution and Genetics

## Reproduction

- Human Reproductive Systems
- The Process of Human Reproduction
- Hormonal Control of Human Reproduction
- Hormonal Control of Human Reproduction (Fertility)
- Hormonal Control of Human Reproduction (Harmful Substances)

## Evolution

- Evidence from the Fossil Record
- Biogeography
- Homology
- Natural Selection
- Mechanisms of Evolution
- Origins of Life
- Evolution
- Evolution (Moth Populations and Industrial Melanism)
- Evolution (Hardy-Weinberg Equation)
- Fossils

## Adaptation

- Variations and Adaptations of Organisms
- Adaptation
- Adaptations of Plants to Life on Land

## Genetics

- Cell Differentiation
- The Structure and Function of DNA and RNA
- The Structure and Function of DNA and RNA (Building a DNA Model)
- The Structure and Function of DNA and RNA (Extracting DNA from Kiwi Fruit)
- Regulation of Gene Expression
- Changes in DNA
- Genetic Crosses
- Meiosis
- The Study of Genomes
- Determining Alleles
- Exploring Genetic Crosses

## LIB 2: 17 Biochemistry and Cell Biology

### Biomolecules

- Structure of Carbohydrates
- Structure of Lipids
- Structure of Proteins
- Structure of Nucleic Acids
- Structure and Function of Enzymes

### Microbiology

- Development of the Microscope
- Microscope Slides  
(Preparing and Viewing a Slide of Onion Cells)
- Microscope Slides
- Microscope Slides  
(Preparing and Observing Microscope Slides)
- Microbiology

### Cells and Cellular Processes

- Cells and the Brain
- Structure of Cells
- Structure of Cells (Neural Processing Times)
- Structure of Cells (Organelles)
- Prokaryotic and Eukaryotic Cells
- Homeostasis and Transport of Molecules
- Viruses
- The Cell Cycle
- Specialized Cells
- Cellular Energy Processes

## LIB 2: 18 The Living World

### Plant Biology

- Reproduction in Flowering Plants
- Reproduction in Flowering Plants (Pollen Tube Growth)
- Reproduction in Flowering Plants (Rate of Photosynthesis)
- Photosynthesis
- Nutrients
- Plant Growth
- Osmosis
- Osmosis (Living Plant Cells)
- Osmosis (Solute Potential)
- Transport Systems in Plants
- Reproductive Systems in Plants
- Response in Plants

### Taxonomy

- Animal Classification
- Life Cycle of the Frog
- Classification of Organisms
- Taxonomic Groups

### Food Chains, Webs, Pyramids and Resources

- Food Chains
- Food Webs
- Ecological Pyramids
- Populations, Resources, and the Environment

### Energy and Living Things

- Aerobic and Anaerobic Respiration

### Nutrient Cycles

- Carbon Cycle
- Nitrogen Cycle

### Population and Biodiversity

- Investigating Populations and Biodiversity
- Impacts on Biodiversity
- Group Behavior
- Population Change and Structure
- Population and Community Responses

## Sustainability

- Food Chains (Human Food Chain)
- Food Chains (DDT and Biomagnification)
- Food Chains
- Global Warming
- Environmental Impact of Chemical Products
- Economic Impact of Chemical Products
- Resources and Recycling

## Ecosystems

- Carrying Capacity of Ecosystems
- Changing Ecosystems
- Ecology
- Microorganisms in Organisms and Ecosystems
- Ecological Succession
- Relationships

# STEM Design

## LIB 2: 19 Engineering Design

### The Design Process

- Introduction to Engineering Design
- Introduction to Engineering Design - Task
- Engineering Problems
- Engineering Problems - Task
- Alternative Solutions
- Alternative Solutions - Task
- Models and Prototypes
- Models and Prototypes - Task
- Communicating Engineering Design
- Communicating Engineering Design - Task
- Design Project - A Railroad Crossing System
- Design Project - A Railroad Crossing System - Task

### Programming

- Switching on a Light Automatically
- Starting a Motor with a Switch
- Using a Conditional Loop
- Stopping a Motor with a Magnetic Switch
- Using a Multiple Loop
- Using the EEPROM Function
- Using Subprograms
- Using Variables

### Building and Testing

- Building a Helicopter
- Building a Conveyor
- Building a Turntable
- Building a Gearbox
- Building a Simple Vehicle
- Building a Screw Thread Mechanism
- Building a Rack and Pinion Mechanism
- Building a Pulley Mechanism
- Using a Magnet and a Magnetic Sensor
- Using a Counter
- Testing a Motor with the Controller
- Testing a Sensor with the Controller
- Using the IR Sensor and the Grayscale Sensor



## LIB 2: 20 Green Technologies

### Biomass

- Creating Power from Biomass
- Biomass Calculations

### Efficiency of Power Generation

- Efficiency of Power Generation
- Turbine Efficiency

### Energy in Buildings

- Energy in Buildings
- Energy and Power
- Energy of the Cloud
- Solar Tracking - Task
- Design Project - An Automatic Sunshade

### Fuel Cells

- Hydrogen Fuel Cell

### Geothermal

- Geothermal Energy
- Geothermal Survey
- Geothermal Challenge

### Glass in Construction

- Glazing Systems
- Glazing Materials

### Heat Pumps

- Cooling
- Heating
- Refrigerants
- Cooling a Large Space
- Passive Cooling

### House Heating Systems

- Heating the Home

### Insulation

- Insulating Buildings
- Insulation Materials

### Hydropower

- Generating Power from Water
- Water Pressure and Depth
- The Hoover Dam
- Powering an Island

### National Grid

- Power Transmission
- Energy Storage
- National Grid Challenge

### Nuclear Energy

- Nuclear Energy
- Nuclear Power

### Power Generation

- Generating Electricity
- Energy and Power
- Exploring Fossil Fuels
- Climate Change

### Solar Electric Systems

- Solar Electricity for the Home
- Grid Connected

### Solar Heating

- Solar Water Heating
- Grid Connected Water Heating

### Solar Power

- Solar Power
- Harnessing Solar Power
- Stirling Engines
- Solar Furnace
- Thermoacoustic Engines

## Wind Power

- Power from the Wind
- Wind Farm
- Harnessing Wind Power
- Wind Power Calculations

## Wind Turbines

- Small Scale Wind Turbines
- Storing Electricity
- Power in the Wind

# LIB 2: 21 Mechanical Systems

## Machines

- Mechanical Systems
- Simple Machines - Task

## Machine Design

- Designing a Slow Turntable - Task
- Design Project - An Elevator - Task
- Design Project - A Fairground Ride - Task
- Problem Solving - Designing an Engine Cam
- Designing a Winch - Task

## Friction

- Friction
- Lubricants, Bushes, and Bearings

## Inclined Planes

- Raising Loads using Inclined Planes

## Levers

- First, Second, and Third Class Levers

## Gears

- Gears and Simple Gear Trains
- Compound Gear Trains
- Special Gears

## Pulleys

- Pulley Belt Drive
- Pulleys
- Fixed and Moveable Pulleys

## Cams and Cranks

- Cams and Cranks
- Cams
- Cranks

# LIB 2: 22 Electronics

## Basic Electricity

- Basic Electrical Quantities in Circuits
- Measurement in Circuits
- Simple Lamp Circuit
- The Lamp Circuit
- Measuring Voltage in a Circuit
- Measuring Resistance of Components
- Experimenting with Voltage, Current, and Resistance
- Connecting Switches
- Generating Light

## Building on Breadboard

- Breadboarding
- Planning an Automatic Light Circuit on Breadboard
- Building the Automatic Light Circuit on Breadboard

## Building on Stripboard

- Building Circuits on Stripboard
- Planning an Anti-Theft Device
- Building and Testing the Anti-Theft Device

## Building Circuits on Printed Circuit Boards

- Constructing the Continuity Tester on PCB
- Building Circuits on PCB

## Electronic Problem Solving

- Problem Solving - Identify Electronic Components
- Problem Solving - Produce an Electronic Circuit Diagram (simulator)
- Problem Solving - Plan, Construct and Test an Electronic Circuit
- Problem Solving - Construct an Electronic Circuit
- Problem Solving - Recognize and Select Components
- Problem Solving - Testing and Fault Finding on Electronic Components (board)

## LED Lamp Circuit

- Resistors
- Calculating the Resistor Value for an LED Lamp Circuit
- Building an LED Lamp Circuit (simulator)
- Building an LED Lamp Circuit
- Testing a Faulty LED Lamp Circuit (board)

## Automatic Light Circuit

- Systems and Sub-Systems
- Building and Testing an Automatic Light Circuit (simulator)
- Building and Testing an Automatic Light Circuit
- The Voltage Divider Principle
- Building and Testing the Improved Automatic Light Circuit
- Building and Testing an Improved Automatic Light Circuit (board)
- Testing a Faulty Improved Automatic Light Circuit (board)

## Power Supplies

- AC to DC Concepts and Principles
- A Simple AC to DC Converter
- Circuit Breakers and Fuses

## Baby Alarm

- Building a Baby Alarm
- Building a Baby Alarm (board)

## Flashing Doorbell Circuit

- Flashing Doorbell Circuit
- Building a Flashing Doorbell Circuit (simulator)
- Building a Flashing Doorbell Circuit

## Freezer Temperature Warning Circuit

- Building the Freezer Temperature Warning Circuit on Breadboard

## Intruder Alarm

- Intruder Alarm Circuit
- Intruder Alarm Circuit (Simulator)
- Latched Buzzer Circuit
- Simulated Latched Buzzer Circuit (simulator)

## Polarity Tester

- Building and Testing a Polarity Tester
- Building and Testing a Polarity Tester (simulator)

## Elevator Door Controller

- The Elevator Door Controller
- The Elevator Door Controller (simulator)

## Road Crossing Controller

- Road Crossing Controller

## LIB 2: 23 Fluid Power

### Principles of Pneumatics

- Fundamental Principles of Pneumatics
- Making use of Pneumatics
- Compressing Air

### Pneumatic Components, Symbols and Circuits

- Pneumatic Circuit Symbols and Conventions
- Building a Simple Circuit
- Double-Acting Cylinder Circuit
- Control Valves
- Shuttle Valves
- Speed Control and Flow Regulators

### Pneumatic Logic

- Logical Control of Cylinders
- Boolean Logic

### Pneumatic Problem Solving

- Problem Solving - Sorting Parts
- Problem Solving - Dump Truck Design

### Sequential and Automatic Control Circuits

- Automated Control Systems
- Manual and Automatics
- Sequence and Repetition

### Pneumatic Circuit Time Delays

- Time Delay Fundamentals

### Electro-pneumatics

- Combining Pneumatics and Electronics

### Levers and Movement

- Lever Principles

### Principles of Hydraulics

- Hydraulic Applications
- Compressing Fluids!
- Building a Hydraulic Circuit
- Hydraulic Laws
- Lifting Force
- Basic Fluid Power Engineering

### Hydraulic Components, Symbols and Circuits

- Symbols and Components
- Hydraulic Components
- Constructing from a Circuit Diagram

### Hydraulic Cylinders

- Controlling Cylinders
- Cylinder Speed
- Hydraulic Cylinder Design
- Design a Cylinder
- Fluid Power Cylinders

### Valves and Flow Control

- Hydraulic Control and Check Valves
- Danger - High Pressure
- Basic Control Valves

### Actuators

- Hydraulic Actuators
- Hydraulics in Operation
- Hydraulic Motor Control

### Creating Pressure with Pumps

- Hydraulic Pumps

## LIB 2: 24 Construction

### Forces on Structures

- Forces
- Skyscrapers

### Concrete

- Using Concrete for Building

### Beams

- Beams

### Building Bridges

- Bridge Design

### Green Materials in Construction

- Construction with Green Materials

## LIB 2: 25 Telecommunications

### Communication Methods

- Early Communication
- Electronic Communications in Everyday Life

### Broadcasting

- Broadcast Communication
- Digital TV and Radio

### Telephones

- Telephone Communication

### Cell Phones

- Cell Phones

### Networks

- Cell Phone Networks
- Networks
- Communication on the Internet

## LIB 2: 26 Manufacturing

### Design

- Design Loop
- Design Choices
- Design and Make a Door Knob
- Manufacturing Technology - Task
- Design Project - Manufacturing Technology - Task

### Materials

- Plastic Materials
- Metals
- Smart Materials
- Physical Properties of Materials
- Mechanical Properties of Materials
- Testing Materials
- Materials Selection: Electric Cables
- Materials Selection: Strength to Weight Ratio

## Manufacturing Engineering

- Injection Machine Controls
- Hand Tools
- Machine Tools and Fabrication

## Waste Management

- Manufacturing Processes and Waste
- Recycling Waste
- Reducing Waste and Cost

# LIB 2: 27 Transportation

## Research and Design

- An Introduction to Research and Design
- Research and Design Approach
- The Design Loop
- Transit System

## Transportation Systems

- Transportation Systems
- Transportation Technologies
- Transportation in Practice

## Propulsion Systems

- Types of Propulsion
- Propulsion Systems and the Environment
- Fuels
- Power and Control - Task
- Torque - Task

## Transportation Logistics

- Modes of Operation

## Moving the Maglev

- Magnets and Electromagnets
- Systems that use Magnetism
- Electrical Power Supply

## Force and Momentum

- Forces
- Momentum

## Passenger Safety

- Passenger Safety
- Passenger Safety (Buffer Design)
- Passenger Safety (Buffer Evaluation)

## Manufacturing Engineering

- Introduction to Transportation
- Power and Control
- Torque

## Manufacturing Waste

- Intelligent Vehicles
- Freight Transport

## Problem Solving Design

- Introduction to Transportation - Task

## Intelligent Vehicles

- Intelligent Vehicles - Task

## Freight Transport

- Freight Transport - Task

## Dump Truck

- Design Project - A Dump Truck - Task

## Program Control

- Programming
- Controlling the Service

## Costs

- Operating Costs
- Lowering Passenger Ticket Prices

## LIB 2: 28 Agriculture

### Farming Technology

- Irrigation
- Irrigation - Task
- Artificial Environments
- Artificial Environments - Task
- Design Project - Vertical Farming System - Task

### Machinery

- Agricultural Machines 1
- Agricultural Machines 1 - Task
- Agricultural Machines 2
- Agricultural Machines 2 - Task

## LIB 2: 29 Biomedical Technology

### Hygiene

- Sanitation
- Sanitation - Task

### Diagnostic Equipment

- Medical Scanning
- Medical Scanning - Task
- Design Project - Model Scanner Improvements - Task

### Treatment and Prevention

- Vaccination and Immunization
- Vaccination and Immunization - Task
- Pharmaceuticals
- Pharmaceuticals - Task

## LIB 2: 30 Robotics

### Controlling Robots

- Manual Control of a Robot
- Programming a Robot
- Open and Closed Loop Control

### Industrial Robotics

- Industrial Machines
- Industrial Machines - Task
- Controlling Machines
- Controlling Machines - Task
- The Control Loop
- Sensors
- Sensors - Task
- Actuators
- Actuators - Task
- Industrial Robots
- Industrial Robots - Task
- Computers and Manufacturing
- Design Project - An Industrial Robotic System - Task

### Mobile Robotics

- Introduction to Mobile Robots
- Introduction to Mobile Robots - Task
- Powering Mobile Robots
- Powering Mobile Robots - Task
- Controlling Mobile Robots
- Controlling Mobile Robots - Task
- Sensors for Mobile Robots
- Sensors for Mobile Robots - Task
- Space Robots
- Space Robots - Task
- Design Project - An Automated Guided Vehicle - Task

### Robots in Action

- Transportation Around the Work-Cell
- Manipulating Parts
- Industrial Robots
- Computer Integrated Manufacture
- Pre-programmed Sequences
- Problem Solving - Nuclear Work-Cell

# Support

## LIB 2: 31 English Language

### Language

- Learning Language
- Language Acquisition

### Reading

- Citing Evidence to Support Analysis
- Identifying Ideas and Analyzing their Development
- Analyzing Connections in a Text
- Identifying Key Words and their Meanings
- Understanding the Role of Structure
- Determining the Author's Purpose and Point of View
- Understanding and Using Information in Different Mediums
- Considering Whether Arguments are Credible and Accurate
- Writing a Comparative Essay
- Citing Strong and Thorough Evidence
- Identifying and Analyzing Ideas in a Text
- Understanding and Interpreting a Text
- Understanding the Different Meanings of Language
- Understanding the Structure of a Text
- Determining a Writer's Perspective
- Understanding Multiple Sources of Information
- Evaluating Arguments and Specific Claims Made in a Text

### Speaking and Listening

- Listening and Responding to Different Perspectives
- Debating an Issue
- Thinking About the Reliability of a Speaker
- Selling to an Audience
- Presenting a Persuasive Speech
- Planning, Writing, Presenting, and Evaluating
- Discussing Different Perspectives
- Justifying Decisions with Reasoning
- Engaging in Group Discussions
- Presenting a Perspective to an Audience

### Writing

- Planning and Writing an Argument
- Planning and Writing a Persuasive Article
- Writing a Formal Letter
- Writing an Informative Text
- Presenting Information to an Audience
- Writing a Newspaper Article
- Writing a Narrative
- Writing From Another Person's Perspective
- Writing a Poem
- Arguing a Perspective
- Presenting a Persuasive Perspective
- Formal Letters with a Perspective
- Creating an Informative Text
- Informing an Audience
- Writing an Informative Article
- Understanding and Using Perspective in a Narrative
- Writing Reality as a Narrative
- Writing History



## LIB 2: 32 Mathematics

### Units of Measure

- Units of Measurement

### Approximation

- Approximations

### Arithmetic

- Adding and Subtracting
- Multiplication and Division of Decimal Numbers
- Multiply Sums

### Fractions

- Fractions - Addition and Subtraction
- Fractions - Multiplication and Division
- Use Fractions
- Simplify Fractions
- Expand Fractions
- Convert Mixed Numbers into Improper Fractions
- Convert Improper Fractions into Mixed Numbers
- Add and Subtract Fractions with the Same Denominator
- Add and Subtract Fractions with Different Denominators
- Convert Fractions to Decimal Numbers
- Convert Decimal Numbers to Fractions

### Percentages

- Percentages
- Calculate Percentages of Values
- Parts per Thousand
- Calculate Percentage Increases
- Calculate Percentage Reductions

### Length, Area and Volume

- Lengths, Surface Area, and Volume
- Lengths, Units and Prefixes
- Calculate the Perimeter of a Rectangle
- Calculate the Area of a Rectangle
- Calculate the Area of a Complex Shape
- Calculate Volume

### Angles

- Angular Measure

### Graphs and Charts

- Graphs - Straight Line Graphs
- Graphs - Square Law
- Graphs - Pie Chart

### Equations

- Transposing Equations
- Performing Calculations
- Sign Rules for Mathematical Operations
- Distributive Law
- Multiply Out Brackets
- Structure Equations
- Transform Equations by Addition and Subtraction
- Transform Equations by Multiplication and Division
- Transpose Equations
- Calculate the Unknown Variable in an Equation
- Equating Method for Solving Simultaneous Equations
- Addition Method for Solving Simultaneous Equations

### Algebra

- Algebra - Simple Formula
- First, Second, and Third Order Brackets
- Rule of Three (Direct Proportion)
- Rule of Three (Inverse Proportion)

### Factorization

- Simple Factorization

### Indices

- Indices - Powers of 10
- Indices - Addition and Subtraction
- Indices - Multiplication and Division
- Indices - Letter Notation
- Powers
- Indices
- Square Roots

## Trigonometry

- Pythagoras' Theorem
- Basic Trigonometry

## Phasors

- Phase Angles
- Phasor Diagrams

# LIB 2: 33 Information Technology

## Introduction to IT

- Types of Computers
- Anatomy of a Computer
- Computer Performance, Speed, and Storage
- PC Unit Components
- Input Devices
- Output Devices
- Storage Devices
- Software Terms
- Operating Systems and Applications
- Shareware, Freeware, and Firmware
- Network Components and Terminology
- Basic Internet Concepts
- Uses of Computers in the Workplace
- Email, Messaging, and eCommerce
- Safety and Security
- User Passwords and Backups
- Malware
- IT Review Task

## Accessing the Internet

- Browser Basics
- Accessing a Website
- Tabs
- Electronic Communications Review Task 1
- Web Searching and Printing
- Working with Data
- Using Favorites
- Electronic Communications Review Task 2
- Web Accelerators
- Security and Web Safety
- Security Features
- Electronic Communications Review Task 3
- Managing Information
- Managing History
- RSS Feeds
- Additional Components
- Electronic Communications Review Task 4
- Electronic Communications Review Task 5

## Using MS Windows

- Windows Desktop
- Text Editors
- Wordpad
- Folders
- Folder Trees
- Moving and Copying
- Help and Applications
- MS Sticky Notes
- Media Player
- MS Paint
- Capturing Images and Changing Colors
- Drawing in MS Paint
- Internet Explorer 1
- Internet Explorer 2
- Using MS Windows Review Task 1
- Using MS Windows Review Task 2

## Word Processing

- Introduction to Word Processing
- Editing Text 1
- Editing Text 2
- Formatting Text 1
- Formatting Text 2
- Formatting Text 3
- Lists and Tables 1
- Lists and Tables 2
- Lists and Tables 3
- Lists and Tables 4
- Page Layout, Pictures, and Printing 1
- Page Layout, Pictures, and Printing 2
- Page Layout, Pictures, and Printing 3
- Page Layout, Pictures, and Printing 4
- Introduction to Mail Merge
- Word Processing Review Task 1
- Word Processing Review Task 2

## Spreadsheet

- Introduction to Spreadsheets
- Working with Cells
- Working with Rows and Columns
- Working with Text
- Formatting Text
- Sorting and Filtering 1
- Sorting and Filtering 2
- Working with Formulae
- Formatting Numbers
- Numbers and Formulae
- Working with Tables 2
- Working with Charts 2
- Working with Graphs 1
- Working with Graphs 2
- Spreadsheets Review Task 1
- Spreadsheets Review Task 2

## LIB 2: 34 Employability Skills

### Social Skills

- Punctuality
- Dress Code
- Personal Space
- Attending a Meeting
- Handle Collective Property
- Common Courtesies

### Language Skills

- Speak on the Telephone
- How to Introduce Yourself
- Listening and Understanding
- Engage in a Two-Way Conversation

### Customer Service

- Handling a Telephone Call



For more information on our range of learning resources, please contact:

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