# Objectives, Concepts & Skills, and Vocabulary

| UNIT | LAB | OBJECTIVES |
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| **1: Environmental Issues** | 1: Landfills | • Create a simulated landfill<br>• Test the biodegradability of natural and synthetic materials<br>• Prepare microscope slides of soil microbes<br>• Examine soil samples for microbes |
| | 2: Radiation Effects | • Identify the effect of ionizing radiation on DNA.<br>• Determine percent germination and mortality rates of seeds that have been exposed to varying levels of radiation.<br>• Compare the growth and development of plants from irradiated seeds. |
| | 3: Bioremediation of an Oil Spill | • Investigate how naturally-occurring microorganisms break down oil<br>• Model various oil spill scenarios<br>• Determine how porosity impacts cleaning up oil spills<br>• Observe the physical changes that take place in oil during biodegradation |
| | 4: Climate Change | • Model the greenhouse effect<br>• Test the effect of increased carbon dioxide concentration on atmospheric warming |
| | 5: Water Pollutants | • Model the effect of runoff on a pond<br>• Calculate volume and mass of discharge after a rain event |
| **2: Air, Water, and Soils** | 6: Air Quality | • Collect and examine pollutants in the air<br>• Identify potential sources of air pollution<br>• Estimate air pollutant levels using traffic volume and lichen persistence |
| | 7: Soils | • Investigate the composition of soil<br>• Determine the particle composition of soil samples<br>• Measure the porosity and permeability of soil samples<br>• Identify the relationship among porosity, permeability, and soil particle size |
| | 8: Water Quality | • Determine the pH and nitrogen, phosphorus, and potassium content of soil samples<br>• Perform a serial dilution and compare concentrations of solutions that result<br>• Investigate the effects of pollutants on plant growth and development<br>• Determine the amount of dissolved oxygen in a water sample<br>• Use colorimetric techniques to measure water pollutants<br>• Determine the $LD_{50}$ of copper sulfate in brine shrimp |

| CONCEPTS & SKILLS | VOCABULARY |
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| Microorganisms, biodegradation, open landfills, sanitary landfills, methane gas, recycling, refuse | Garbage, trash, biodegradation, open landfills, leachate, sanitary landfills |
| Plant growth and development, radiation, mutations, DNA, experimental design, analytical thinking, making observations | Atoms, protons, neutrons, nucleus, electrons, mutations, control group, radicle, cotyledons |
| Microorganisms, ecosystem, food chains, analytical thinking, making observations and predictions, biodegradation, bioremediation, porosity | Fossil fuels, porosity, biodegradation, bioremediation |
| Analytical thinking, making observations, greenhouse gases, global warming, climate change, fossil fuels, solar radiation, heat and energy, weather, atmosphere | Atmosphere, greenhouse gases, grennhouse effect, global warming |
| Analytical thinking, making observations and inferences, experimental design, soil horizons, porosity, permeability, colorimetric soil tests, nutrient content of soil, soil analysis, soil pH | Rock salts, deicers, melting point, exothermic reaction, runoff, groundwater, water table, density, salinity |
| Analytical thinking, making observations and inferences, experimental design, lichens, air pollution, biological indicator, making field observations, analyzing data | Air pollution, particulate pollution, biological indicators, lichen |
| Analytical thinking, making observations and inferences, experimental design, soil horizons, porosity, permeability, colorimetric soil tests, nutrient content of soil, soil analysis, soil pH | Soil, humus, loam, horizons, permeability, porosity |
| Analytical thinking, making observations and inferences, experimental design, acid rain, seed germination, plant growth and development, pollution, colorimetric tests (copper, nitrates, phosphates, pH, dissolved oxygen), dissolved oxygen, toxicology, $LD_{50}$, concentrations, parts per million (ppm) | Parts per million, parts per billion, parts per trillion, nitrates, hardness, chlorine, pH, dissolved oxygen, aquatic toxicology, toxicant, lethal dose 50 ($LD_{50}$) |

# Objectives, Concepts & Skills, and Vocabulary

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| **3: Ecosystems, Energy, & Biodiversity** | 9: Learning About Food Webs & Energy Pyramids | • Build model food chains from different habitats<br>• Model food webs<br>• Model energy flow through trophic levels<br>• Investigate the roles of producers, consumers, scavengers, and decomposers in a food chain or web |
| | 10: Using Owl Pellets to Learn about Predator-Prey Relationships | • Dissect an owl pellet<br>• Identify prey organisms using a dichotomous key<br>• Construct a food web |
| | 11: Biodiversity | • Calculate and compare biodiversity indices for different leaf litter ecosystems<br>• Observe a cell population in culture<br>• Measure cell populations using optical density<br>• Determine the carrying capacity of a population |
| **4: Comprehensive Inquiry Investigation** | 12: Culminating Lab | • Model a typical water purification method used by water treatment plants<br>• Model biological treatment of water pollutants<br>• Assess the level of pollution (nutrient loading) of a water source by calculating the composite Palmer score |

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| Analytical thinking, making observations, biomes, habitats, food chains and webs, energy pyramid, trophic levels, producers, consumers, scavengers, decomposers | Ecosystem, autotrophs, heterotrophs, trophic levels, producers, consumer, herbivores, carnivores, food chain, scavengers, decomposers, food webs, energy pyramid, biomes, habitat, wetlands, deserts, forests, tundra, grasslands |
| Analytical thinking, making observations, predator-prey relationships, owl pellets, food webs, dissection, dichotomous key | Predators, prey, owl pellet, regurgitation, photosynthesis, trophic level, producers, consumers, herbivores, carnivores, omnivores, scavengers, decomposers, food chain, food web |
| Analytical thinking, collecting and sorting leaf litter organisms, making observations and inferences, calculating biodiversity indices, cell observation techniques, collecting and analyzing data, carrying capacity, Berlese apparatus, experimental design, mathematics, environments, ecosystems, and habitats | Leaf litter, humus, biodiversity, diversity index, population, carrying capacity, lag phase, exponential phase, stationary phase, death phase |
| Ground water, water pollution, porosity, permeability, bioremediation, toxicology, biodiversity, ecosystems, runoff/discharge | Aeration, coagulation, floc, sedimentation, filtration, bioremediation, biological assessment, biological indicators, nutrient pollution (nutrient loading) |