

# Objectives, Concepts & Skills, and Vocabulary

UNIT	LAB	OBJECTIVES
1: Understanding DNA	1: DNA Structure and Replication	<ul style="list-style-type: none"> <li>• Model the structure of DNA</li> <li>• Simulate the process of DNA replication</li> </ul>
	2: Extracting DNA	<ul style="list-style-type: none"> <li>• Isolate and observe DNA from plant cells</li> <li>• Describe the appearance and physical characteristics of isolated DNA</li> <li>• Prepare an onion lysate solution</li> </ul>
2: Biotechnology Techniques I – Gel Electrophoresis	3: Simulating Gel Electrophoresis	<ul style="list-style-type: none"> <li>• Understand how restriction enzymes are used</li> <li>• Simulate the process of restriction enzyme digestion</li> <li>• Learn about the principles of gel electrophoresis</li> </ul>
	4: Exploring Molecules Using Gel Electrophoresis	<ul style="list-style-type: none"> <li>• Demonstrate the use of electrophoresis</li> <li>• Learn how electrophoresis separates and sorts DNA fragments</li> <li>• Demonstrate the effects of restriction enzymes on DNA</li> <li>• Use a standard curve to determine the molecular mass and base pair size of DNA fragments</li> </ul>
	5: Mapping Restriction Site Landmarks of a DNA Sample	<ul style="list-style-type: none"> <li>• Explain how electrophoresis separates and sorts DNA fragments</li> <li>• Demonstrate the effects of restriction enzymes on DNA</li> <li>• Interpret data by using a standard curve to determine the base pair size of DNA fragments</li> <li>• Map the restriction site landmarks of bacteriophage (<math>\lambda</math>) DNA</li> </ul>
3: Biotechnology Techniques II – Gene Expression	6: A Closer Look at Bio-Engineering	<ul style="list-style-type: none"> <li>• Simulate the process of restriction enzyme digestion</li> <li>• Simulate the creation of recombinant DNA</li> </ul>
	7: How Genes Express Themselves	<ul style="list-style-type: none"> <li>• Observe the varying colors of bacteria grown under different temperature conditions</li> <li>• Understand the relationship between gene expression and the environment</li> <li>• Learn how to use aseptic techniques when culturing bacteria</li> <li>• Learn about the mechanics involved in gene expression</li> </ul>
4: Comprehensive Inquiry Investigation	8: Culminating Lab	<ul style="list-style-type: none"> <li>• Demonstrate the process of bacterial transformation</li> <li>• Calculate transformation efficiency</li> <li>• Understand the techniques used in genetic engineering</li> <li>• Determine which form (genotype) of the ApoE gene an individual has</li> </ul>

CONCEPTS & SKILLS	VOCABULARY
Modeling, hydrogen bond, double helix, base pairs, DNA nucleotides, DNA replication, analytical thinking	Deoxyribonucleic acid, nucleotides, covalently bonded, phosphate group, nitrogen base, genetic code, proteins, amino acids, polymer, adenine, guanine, cytosine, thymine, pyrimidines, purines, complementary, base pairs, hydrogen bonding, double helix, denatured, antiparallel
Biotechnology applications, cell structure, DNA extraction, DNA structure and function, making observations, analytical thinking	Biotechnology, deoxyribonucleic acid, nucleus, nuclear membrane, nucleic acid, double helix, macromolecule, viscoelasticity, cell wall, cell membrane, enzyme, DNase
Restriction enzymes, DNA double helix, gel electrophoresis, making observations, analytical thinking, making models, conductivity, molecular weight, electrical current	Restriction enzymes, digestion, bacteriophage, prokaryotic organism, blunt ends, sticky ends, recombinant DNA, ribonucleic acid, uracil, gel electrophoresis, cathode, anode
Analytical thinking, making observations, interpreting data using standard curves, molecular weight and charge, restriction enzymes, anode and cathode, gel electrophoresis, using a micropipet, biotechnology applications	Molecular mass, electrolysis, base pair
Analytical thinking, genes, restriction fragment length polymorphisms (RFLPs), DNA mapping, electrophoresis, human genome project, making observations, interpreting data, restriction enzymes	Gene, genome, Human Genome Project, chromosome, restriction enzymes, polymorphism, restriction fragment length polymorphism
Restriction enzymes, DNA structure, making observations, plasmid, analytical thinking, making models, recombinant DNA, genes and chromosomes	Genetic engineering, plasmid, recombinant DNA, host
Microbiology, genes, gene expression, making observations, analytical thinking, conducting an experiment, interpreting data, aseptic techniques, genetic engineering, genetics, biochemistry, bacteria culturing	Agar, genotype, phenotype, gene expression, prodigiosin
Genetic engineering, bacterial culturing, DNA, gene expression, chromosome mapping, complementary base pairing, collecting and tabulating data	Genetic engineering, bacterial transformation, plasmids, restriction enzymes, recombinant DNA, host, conjugation, pUC18, ampicillin, genome, alleles, homozygous, heterozygous, messenger RNA, gene expression, gene products, DNA chip