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Virtual World of Science Education

PRAXILABS
3D SIMULATIONS
PORTFOLIO V8

Detailed

Biology | Chemistry | Physics

Africa's Business Heroes
Award Winner

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Experiments Index

Biology

Molecular Biology – Genetics – Microbiology – Biochemistry

- DNA Extraction 2
- Conventional PCR 2
- Agarose Gel Electrophoresis 2
- RNA Extraction 3
- CDNA Synthesis 3
- Real-Time PCR 3
- DNA Sequencing 3
- DNA Microarray 4
- Flow Cytometry Cell Cycle 4
- XTT Viability Assay 4
- In Vitro Cell Viability by the Lactate Dehydrogenase Assay (LDH) 5
- In Vitro Cell Viability by the Alamar Blue Assay 5
- In Vitro Mammalian Cells COMET Assay 6
- In Vitro Histone H2AX Phosphorylation Assay 6
- In Vitro 8OHdG DNA Adduct Assay 7
- In Vitro Bromodeoxyuridin BrdU Assay 7
- Annexin V Assay 8
- Gram Stain 8
- Ziehl-Neelsen Staining Technique 8
- Cultivation and Preparation of the Virus in Chick Embryo 9
- Preparation of Washed Red Blood Cells 9
- Haemagglutination Tests 9
- Cloning-DNA Isolation and Restriction Digestion 10
- Cloning-Transformation 10
- Cloning-Blue and White Screening 10
- Cloning-Growth and Isolation of Plasmid DNA using Alkaline Lysis Method 11
- Cloning-DNA Agarose Gel Electrophoresis of Digested Plasmid and Selection for Sequencing 11
- Cloning-Isolation of Sequencing Grade Plasmid 11
- Bacterial Plating Out Technique Experiment (Streak Plate Method) 12
- Antibiotic Sensitivity Test (Disc Diffusion Method) 12
- Coagulase Test 12
- Catalase Test 12
- Oxidase Test 13
- Indole Test 13
- Spread Plate Technique 13
- Urease test 14
- Widal Test 14
- Citrate Test 14
- Mitosis in Onion Rings 14

Biochemistry - Immunology

- ELISA Sandwich 15
- Flow Cytometry 15
- Production of Monoclonal Antibodies (mAB) - Hybridomas Technique 15

Biochemistry – Proteomics

- Protein Electrophoresis (Polyacrylamide Gel Electrophoresis - PAGE) 16
- 2D Protein Electrophoresis (Isoelectric Point Focusing, PAGE) 16
- Western Blot 16
- Bradford AssayHigh Performance Liquid Chromatography 17
- In Vitro Acid Phosphatase Assay for Cell Viability 17

Biochemistry – Proteomics – Pharmacology – Toxicology

- Adherent Cell Culturing using Mammalian Cell Lines 18
- In Vitro Cytokinesis-Block Micronucleus Assay (CBMN Assay) 18
- In Vitro Chromosomal Aberrations Test 19
- In Vitro Caspase 3 Activity Assay 19
- In Vitro Fluorescein Diacetate/Propidium Iodide (FDA/PI) Staining Assay 20
- In Vitro Neutral Red Uptake Assay 20
- In Vitro Acid Phosphatase Assay for Cell Viability 21

Biochemistry – Immunology – Microscopy - Cell Culture

- ELISpot Assay 22
- Immunofluorescence Assay Production of Monoclonal Antibodies Experiment 22
- Production of Monoclonal Antibodies (mAB) - Hybridomas Technique 22

Biochemistry - Bioenergetics

- Building a Model for Catalytic Interactions 23
- Polarographic Oxygen Respirometry 23

Molecular Biology – Genetics – Microbiology – Biochemistry Forensic

- DNA Fingerprinting using Gel Electrophoresis 24
- Spread Plate Technique 24
- Urease Test 24
- Widal Test 25

Biochemistry – Pharmacology – Toxicology

- XTT Viability Assay 26
- In Vitro Cell Viability by the Lactate Dehydrogenase Assay (LDH) 26
- In Vitro Cell Viability by the Alamar Blue Assay 27
- In Vitro Mammalian Cells COMET Assay 27
- In Vitro Histone H2AX Phosphorylation Assay 28
- In Vitro 8OHdG DNA Adduct Assay 28
- In Vitro Bromodeoxyuridin BrdU Assay 29
- Annexin V Assay 29

Physiology

- Amylase Test 30
- Red Blood Cell Count 30
- Blood Serum Extraction 30

Microbiology

- Triple Sugar Iron Test 31

General Biology

- Introduction to Microscopes (NEW) 32

Chemistry

Organic Chemistry

- Tests for Carboxylic Group 34
- Tests for Hydroxyl Group 34
- Tests for Phenolic Group 34
- Test for Amide Group 35
- Tests for Aldehydic and Ketonic Groups 35
- Diels Alder Reaction 35
- Synthesis of Aspirin 36
- Esterification 36
- Electrophilic Substitution (Azo Coupling) 36
- Reaction of Alkyl Halides (Hydrolysis of Alcohols) 37
- Friedel Crafts Acylation of Anisole 37
- Saponification Reaction 37
- Preparation of β-Naphthyl Acetate 38
- Claisen Schimdt Reaction (Mixed Aldol Condensation) 38
- Preparation of Paracetamol 38
- Grignrad preparation 39
- Preparation of Ethyl Propionate (Propanoic acid ethyl ester) (Fisher Esterification) 39
- Nitration of Methylbenzoate 39
- Test for Carboxylic Acid Group (Lactic Acid) 40

Inorganic Chemistry

- Test for Sulphite Radical 41
- Test for Carbonate Radical 41
- Test for Bicarbonate Radical 41
- Test for Sulphide Radical 42
- Test for Thiosulphate Radical 42
- Test for Chloride Radical 42
- Test for Bromide Radical 43
- Test for Iodide Radical 43
- Test for Sulphate Radical 43
- Test for Phosphate Radical 44
- Test for Mercurous Radical 44
- Test for Silver Radical 44
- Test for Lead Radical 45
- Test for Cadmium Radical 45
- Test for Mercuric Radical 45
- Test for Cupric Radical 46
- Test for Chromic Radical 46
- Test for Ferric Radical 46
- Test for Aluminum Radical 47
- Test for Zinc Radical 47
- Test for Nickelous Radical 47
- Test for Manganous Radical 48
- Test for Barium Radical 48
- Test for Calcium Radical 48
- Test for Magnesium Radical 49
- Test for Ammonium Radical 49
- Test for Sodium Radical 49
- Test for Potassium Radical 50
- Flame Test 50

Analytical Chemistry

- Determination of Sulphuric Acid Concentration by Titration 51
- Analysis Mixture of Sodium Hydroxide and Sodium Carbonate by Warder Titration 51
- Determination of Concentration of Acetic Acid Solution in Its Commercial Vinegar Titration 51
- Determination of Number of Particles of Water Crystallization in Borax 52
- Determination of Concentration of Citric Acid in Soda by Titration 52
- Determination of Concentration of Silver Nitrate by Fajan's Method 52
- Determination of Concentration of Silver Nitrate by Mohr's Method 53
- Determination of Concentration of Chlorides in Water Sample (Volhard's Method) 53
- Determination of Water Hardness by Complexometric Titration 53
- Standardization of Potassium Permanganate 54
- Standardization of Sodium Thiosulphate using Iodimetric Titration 54
- Gravimetric Analysis of Sulphate 54
- GC/MS Analysis 55
- NMR Analysis 55
- IR Analysis 55
- Strong Acid/Strong Base Titration (HCl/NaOH) 56
- Weak Base/Strong Acid Titration 56
- Aspirin titration (Weak Acid / Strong Base Titration) 56
- Determining the percent of citric acid in apple juice 57
- Determining the Molarity of HCl Solution by a Standard Solution of Sodium Carbonate Using Phenolphthalein and Methyl Orange as pH Indicators 57
- Determining the Molarity of NaOH Solution by a Standard Solution of HCl Using Two different pH Indicators Phenolphthalein and Methyl Orange 57

Acidic Radical Tests

- Test for Unknown Acidic Radical 1 58
- Test for Unknown Acidic Radical 2 58
- Test for Unknown Acidic Radical 3 58
- Test for Unknown Acidic Radical 4 58
- Test for Unknown Acidic Radical 5 58
- Test for Unknown Acidic Radical 6 58
- Test for Unknown Acidic Radical 7 59
- Test for Unknown Acidic Radical 8 59
- Test for Unknown Acidic Radical 9 59
- Test for Unknown Acidic Radical 10 59

Basic Radical Tests

- Test for Unknown Basic Radical 1 60
- Test for Unknown Basic Radical 2 60
- Test for Unknown Basic Radical 3 60
- Test for Unknown Basic Radical 4 60
- Test for Unknown Basic Radical 5 60
- Test for Unknown Basic Radical 6 60
- Test for Unknown Basic Radical 7 61
- Test for Unknown Basic Radical 8 61
- Test for Unknown Basic Radical 9 61
- Test for Unknown Basic Radical 10 61
- Test for Unknown Basic Radical 11 61
- Test for Unknown Basic Radical 12 61
- Test for Unknown Basic Radical 13 61
- Test for Unknown Basic Radical 14 61
- Test for Unknown Basic Radical 15 62
- Test for Unknown Basic Radical 16 62
- Test for Unknown Basic Radical 17 62
- Test for Unknown Basic Radical 18 62

Electrochemistry

- Determination of the Standard Electrode Potential of Silver Electrode **(New)** 63

Physics

Heat and Thermodynamics

- Specific Heat of Solids 65
- Byole's Law of Gases 65
- Joule's Experiment 65

Mechanics

- Free Fall 66
- Motion on Inclined Surface 66
- Ballistic Pendulum 66
- Newton's Second Law 67
- Lami's Rule 67
- Static Friction Coefficient 67
- Linear Motion 68
- Projectile Motion (NEW) 68

Electricity

- Measurement of Ohmic Resistances Using Ammeter and Voltmeter 69
- Study the I-V Characteristics of Non-Ohmic Resistance 69
- Kirchhoff's Loop Rule 69
- RC Circuit (Charging Capacitor) 70
- RC Circuit (Discharging Capacitor) 70
- Variation of the Resistance of a Thermistor with Temperature Experiment 70
- Electrostatic Demonstration 71
- Faraday's Law 71
- Parallel Plate Capacitor 71
- Ohm's low 72
- Parallel plates capacitor (NEW) 72
- Equipotential and Field Mapper (NEW) 72

Magnetism

- Magnetic Moment of a Bar Magnet 73
- Magnetic Field of a Circular Loop Current 73
- Temperature Coefficient of Resistance 73
- Magnetic Force on a Wire 74
- Determination of unknown capacitance and inductance using phasor diagrams and AC circuits 74

Modern Physics

- Black Body Radiation 75
- Optics Lab 75
- Laser Beam Divergence 75
- Laser Electro-Optic Effect 76
- Millikan Oil Drop 76
- Michelson Interferometer 76
- I-V Characteristics of Solar Cell (I) 77
- I-V Characteristics of Solar Cell (II) 77
- I-V Characteristics of Solar Cell (III) 77
- Zeeman Effect Experiment 78
- Band Gap Energy of Semiconductors 78
- Franck-Hertz Experiment Using Neon Tube 78

Properties of Matter

- Determination of the Coefficient of Viscosity by Using Stokes Method 79
- Young's Modulus for a Metallic Rod 79
- Archimedes Principle 79
- Density Measurement 80

Waves

- Focal Length of a Convex Lens Using General Law 81
- Simple Pendulum 81
- Hooke's Law 81
- Speed of Sound Using Closed Columns 82
- Speed of Sound Using Open Columns 82
- Forced Oscillations 82

General

- Safety Laboratory 83

PraxiLabs
Virtual World of Science Education

Biology

Molecular Biology | Immunology | Bioenergetics

Toxicology | Genetics | Microbiology | Forensic

Proteomics | Pharmacology | Cell Culture

Biochemistry | Microscopy | Physiology

Molecular Biology | Genetics | Microbiology | Biochemistry

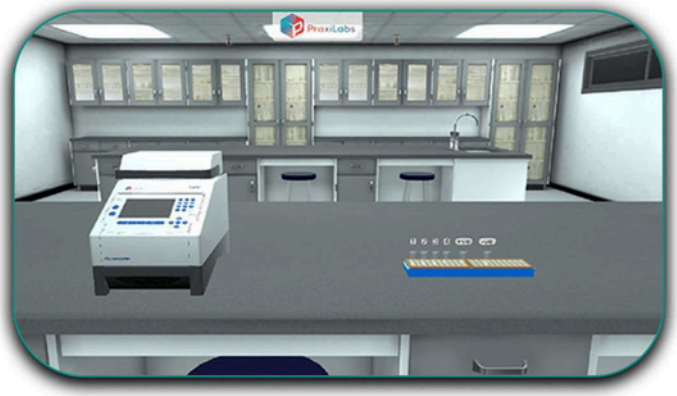
DNA Extraction



Learning Objectives (ILOs)

- Demonstrate proficiency with the protocol involved in DNA extraction
- Identify the role of specific reagents and equipment in the extraction of DNA
- Practice basic laboratory techniques
- Conclude downstream applications of DNA extraction

Conventional PCR



Learning Objectives (ILOs)

- Demonstrate proficiency with the protocol involved in PCR
- Identify the role of specific reagents and equipment in PCR
- Practice basic laboratory techniques
- Conclude downstream applications of PCR

Agarose Gel Electrophoresis



Learning Objectives (ILOs)

- Demonstrate proficiency with the protocol involved in agarose gel DNA electrophoresis
- Identify the role of specific reagents and equipment in DNA electrophoresis
- Prepare an agarose gel properly
- Visualize and understand the precautions required during sample application in the gel
- Practice basic laboratory techniques
- Conclude downstream applications of DNA electrophoresis

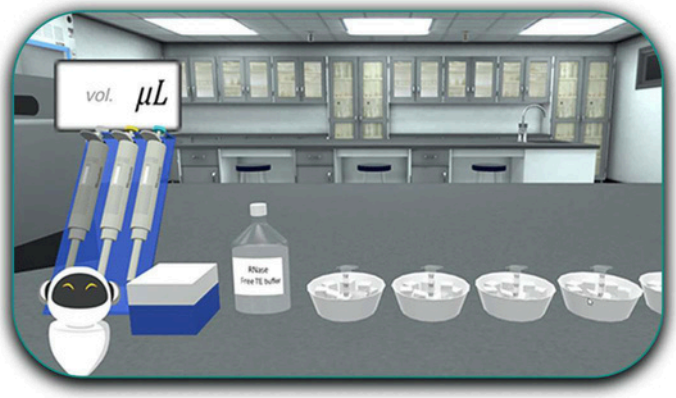
RNA Extraction



Intended Learning Outcomes (ILOs)

- Demonstrate proficiency with the protocol involved in RNA extraction
- Identify the role of specific reagents and equipment in the extraction of RNA
- Practice basic laboratory techniques
- Conclude downstream applications of RNA extraction

CDNA Synthesis



Intended Learning Outcomes (ILOs)

- Demonstrate proficiency with the protocol involved in cDNA Synthesis
- Identify the role of specific reagents and equipment in cDNA Synthesis
- Practice basic laboratory techniques

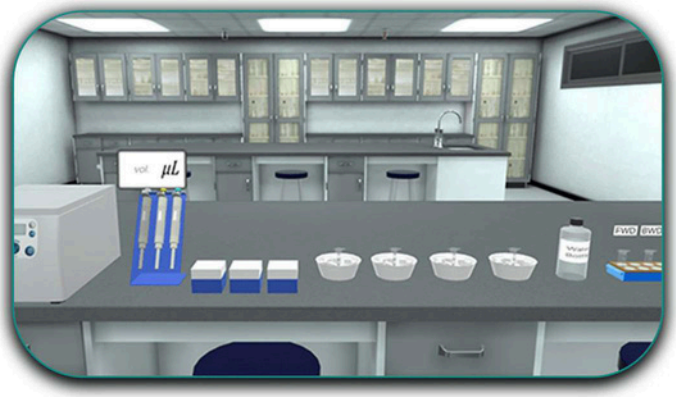
Real-Time PCR



Intended Learning Outcomes (ILOs)

- To identify the steps required to accomplish a successful RT-PCR experiment
- To gain hands-on experience of an RT-PCR protocol

DNA Sequencing



Intended Learning Outcomes (ILOs)

- To apply DNA sample purification using exosap IT
- To apply library preparation steps properly
- To understand and apply DNA fragmentation, adapter ligation, clean up and amplification of tagmented DNA
- To practice library normalization, denaturing and dilution
- To perform AMPure beads protocol to purify DNA libraries

DNA Microarray



Intended Learning Outcomes (ILOs)

- Perform the steps for RNA amplification
- IPractice the laboratory protocols to synthesize cDNA, cRNA and fragment cRNA prior to hybridization
- Practice the technique for dual labelling of samples for microarray hybridization
- Apply the skills and precautions required for microarray slide handling and sample application
- Identify the benefits of positive displacement pipette
- Practice the process of microarray slide wash prior to detection

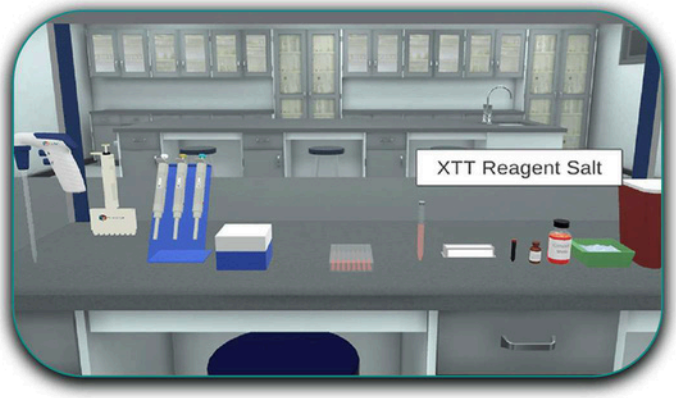
Flow Cytometry Cell Cycle



Intended Learning Outcomes (ILOs)

- To practice the steps of cell fixation and permeabilization
- To understand the concept of cell cycle analysis using propidium iodide

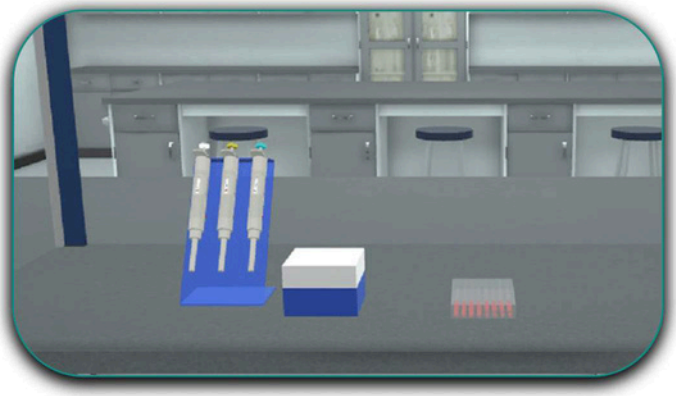
XTT Viability Assay



Intended Learning Outcomes (ILOs)

- Successfully handle the required instruments and consumables needed in the experiment
- Check the confluence and count cells under the microscope
- Dilute the cells to a specific count suitable for seeding in the 96-well plate
- Calculate the concentration of tested chemicals and prepare the calculated doses in the cell culture medium
- Aspirate the old medium and add the new medium containing the tested chemicals in the appropriate wells
- Add the XTT solution to cells and read the results using the microplate reader after incubation of cells
- Read the results of XTT and calculate the viability percent of cells exposed to different doses of tested chemical(s)

In Vitro Cell Viability by the Lactate Dehydrogenase Assay (LDH)



Intended Learning Outcomes (ILOs)

- Successfully handle the required instruments and consumables needed in the experiment
- Check the confluence and count cells under the microscope
- Dilute the cells to a specific count suitable for seeding in the 96-well plate
- Calculate the concentration of tested chemicals and prepare the calculated doses in the cell culture medium
- Aspirate the old medium and add the new medium containing the tested chemicals in the appropriate wells
- Add the LDH assay substrate solution to cells and read the results using the microplate reader after incubation of cells
- Prepare desired concentrations of LDH standard solution in cell culture medium, and draw the standard curve
- Read the results of LDH and calculate the cytotoxicity percent for cells exposed to different doses of tested chemical(s)

In Vitro Cell Viability by the Alamar Blue Assay



Intended Learning Outcomes (ILOs)

- Successfully handle the required instruments and consumables needed in the experiment
- Check the confluence and count cells under the microscope
- Dilute the cells to a specific count suitable for seeding in the 96-well plate
- Calculate the concentration of tested chemicals and prepare the calculated doses in the cell culture medium
- Aspirate the old medium and add the new medium containing the tested chemicals in the appropriate wells
- Add the Alamar Blue solution to cells and read the results using the microplate reader after incubation of cells
- Read the results of Resorufin and calculate the viability percent for cells exposed to different doses of tested chemical(s)

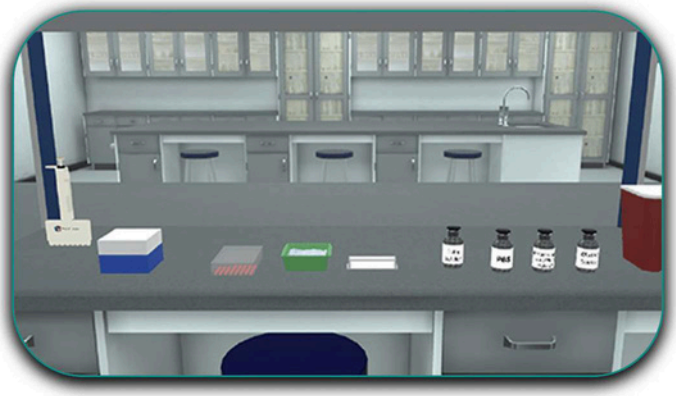
In Vitro Mammalian Cells COMET Assay



Intended Learning Outcomes (ILOs)

- Successfully handle the required instruments and consumables needed in the cell culturing and sub-culturing
- Work and follow the general safety guidelines for Good Laboratory Practice (GLP)
- Strictly work and follow the Aseptic Techniques of cell culturing
- Thaw cells from Liquid Nitrogen and seed them in cell culture flasks
- Check the confluence, harvest cells, and count them microscopically
- Scaling up the cultured cells for the setting of further experiments.
- Freezing cells in Liquid Nitrogen for long-term storage

In Vitro Histone H2AX Phosphorylation Assay



Intended Learning Outcomes (ILOs)

- Successfully handle the required instruments and consumables needed in the experiment
- Check the confluence and count cells under the microscope
- Dilute the cells to a specific count suitable for seeding in the 96-well plate
- Calculate the concentration of tested chemicals and prepare the calculated doses in the cell culture medium
- Aspirate the old medium and add the new medium containing the tested chemicals in the appropriate wells
- Add the H2AX Phosphorylation assay substrate solution to cells and read the results using the fluorescent microscope after incubation of cells

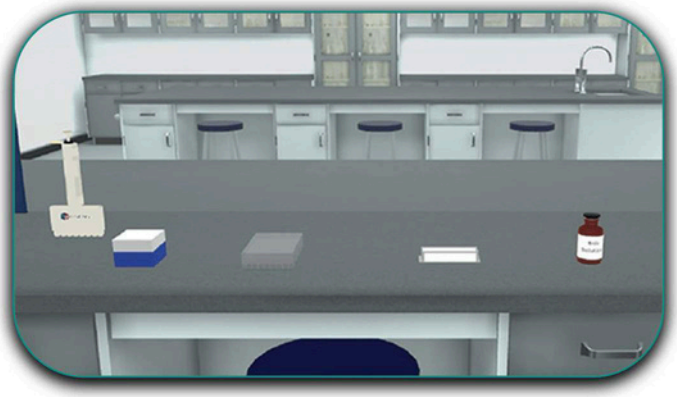
In Vitro 8OHdG DNA Adduct Assay



Intended Learning Outcomes (ILOs)

- Successfully handle the required instruments and consumables needed in the experiment
- Check the confluence and count cells under the microscope
- Dilute the cells to a specific count suitable for seeding in the 96-well plate
- Calculate the concentration of tested chemicals and prepare the calculated doses in the cell culture medium
- Aspirate the old medium and add the new medium containing the tested chemicals in the appropriate wells
- Add the blocking solution, first and secondary antibodies to cells and read the results using the fluorescent microscope after incubation of cells

In Vitro Bromodeoxyuridin BrdU Assay



Intended Learning Outcomes (ILOs)

- Successfully handle the required instruments and consumables needed in the experiment
- Check the confluence and count cells under the microscope
- Dilute the cells to a specific count suitable for seeding in the 96-well plate
- Calculate the concentration of tested chemicals and prepare the calculated doses in the cell culture medium
- Aspirate the old medium and add the new medium containing the tested chemicals in the appropriate wells
- Add the BrdU assay substrate solution to cells and read the results using the fluorescent microscope after incubation of cells with first anti-BrdU and secondary antibodies

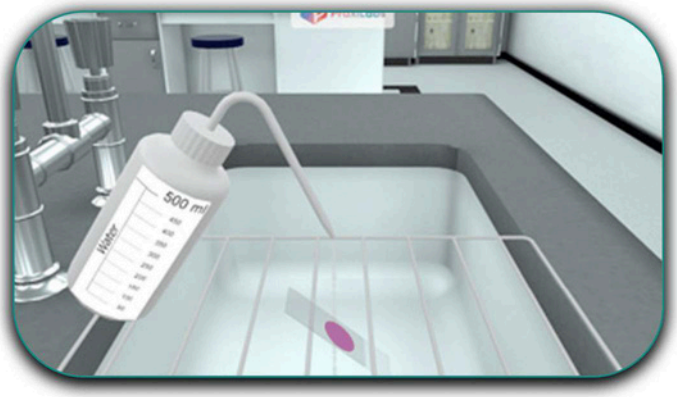
Annexin V Assay



Intended Learning Outcomes (ILOs)

- Successfully handle the required instruments and consumables needed in the experiment
- Check the confluence and count cells under the microscope
- Dilute the cells to a specific count suitable for seeding in the 96-well plate
- Calculate the concentration of tested chemicals and prepare the calculated doses in the cell culture medium
- Treat cells with the cytotoxic agent(s) or nanoparticles and observe under the microscope
- Harvest cells with Annexin-V / Propidium Iodide buffer
- Analyze cells by fluorescent microscope and analyze resulted data. Represent and interpret the resulted data graphically using dot plots

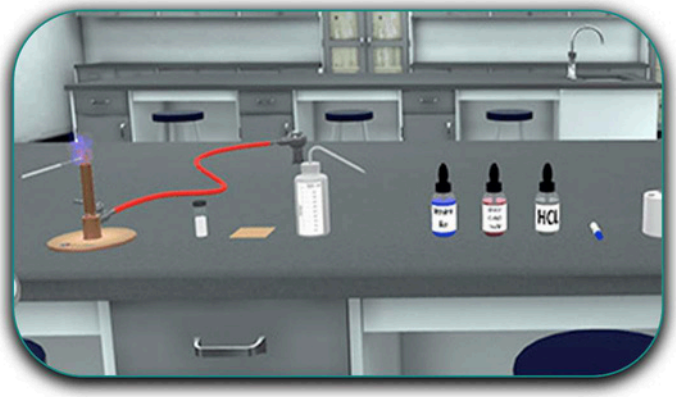
Gram Stain



Intended Learning Outcomes (ILOs)

- Become proficient at performing the gram stain consistently and accurately
- Differentiate between various shapes, sizes, arrangements, and gram reactions of bacteria
- To differentiate between the two major categories of bacteria: Gram positive and Gram negative
- To understand how the Gram stain reaction affects Gram positive and Gram negative bacteria based on the biochemical and structural differences of their cell walls

Ziehl-Neelsen Staining Technique

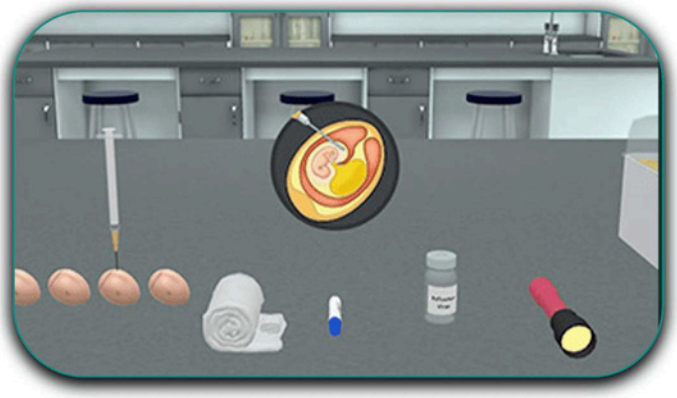


Intended Learning Outcomes (ILOs)

- Become proficient at performing the Ziehl-Neelsen stain consistently and accurately
- To differentiate between acid-fast bacilli and non-acid-fast bacilli
- To stain Mycobacterium species

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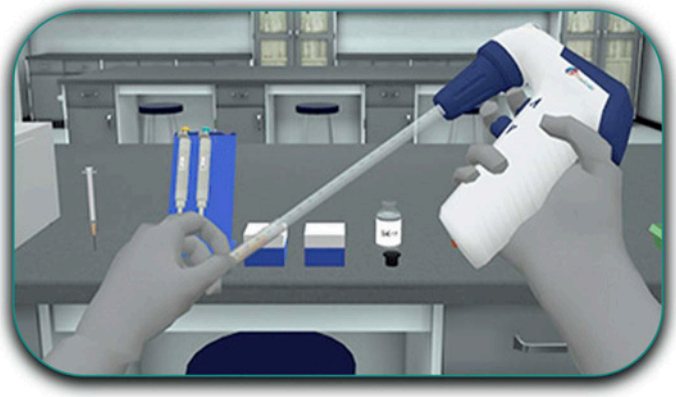
Cultivation and Preparation of the Virus in Chick Embryo



Intended Learning Outcomes (ILOs)

- Become proficient at performing the viral cultivation consistently and accurately
- Student will learn the essential concepts of virology

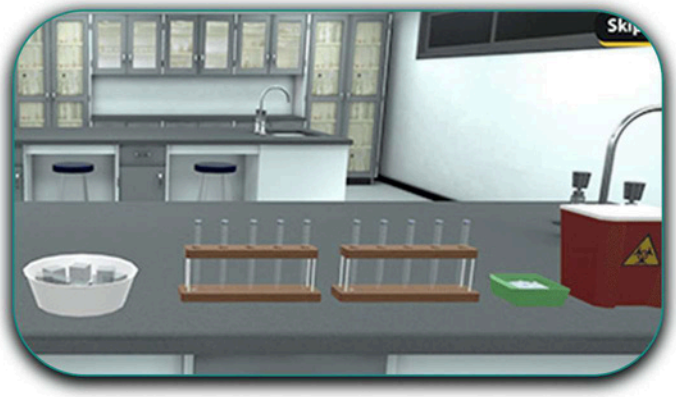
Preparation of Washed Red Blood Cells



Intended Learning Outcomes (ILOs)

- Become proficient at performing preparation of washed RBCs consistently and accurately
- Student will learn the essential concepts of haematological tests

Haemagglutination Tests



Intended Learning Outcomes (ILOs)

- Become proficient at performing Haemagglutination tests consistently and accurately
- Student will learn the essential concepts of haematological tests

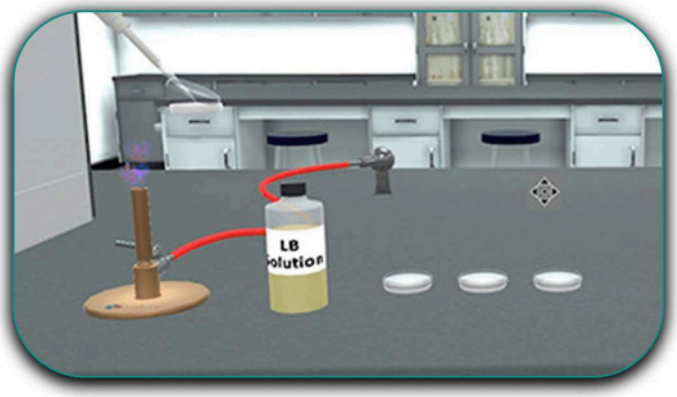
Cloning-DNA Isolation and Restriction Digestion



Intended Learning Outcomes (ILOs)

- To Apply the steps of DNA extraction from a culture of Saccharomyces Cerevisiae
- To execute proper restriction enzyme digestion of DNA
- To understand the role of the devices, the reagents and the enzymes used in the process of DNA extraction
- To implement proper storage of samples

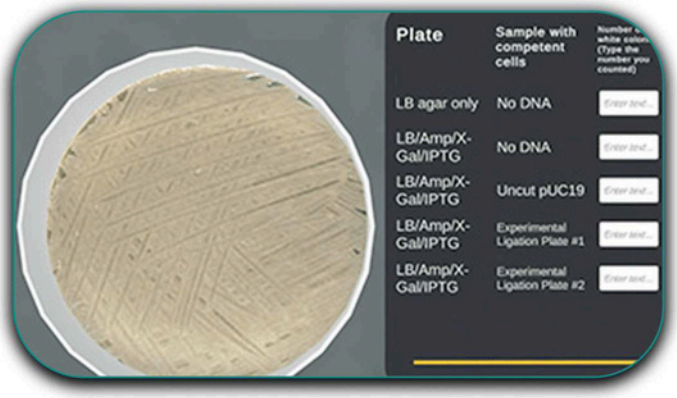
Cloning-Transformation



Intended Learning Outcomes (ILOs)

- To understand the role of the devices, the reagents and the enzymes used in the processes of Recombinant DNA molecule synthesis, competent cells preparation, transformation, and plating
- To apply the steps for recombinant DNA molecule synthesis
- To identify the lab setup required for Transformation and Plating procedures
- To execute a proper protocol for transformation and plating
- To perform the sterile technique
- To implement proper storage of samples

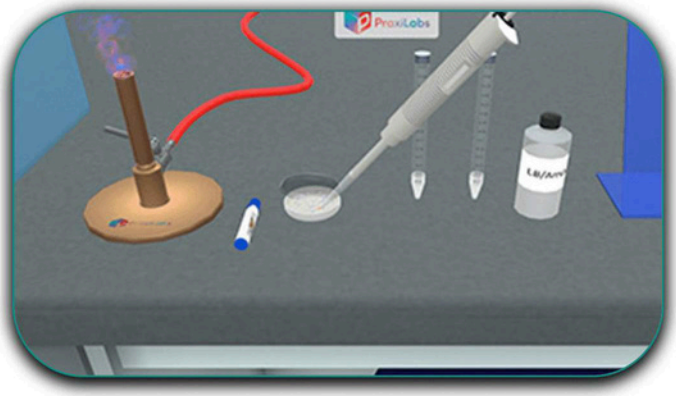
Cloning-Blue and White Screening



Intended Learning Outcomes (ILOs)

- To perform blue/white screening
- To interpret the results on each plate
- To calculate the transformation efficiency

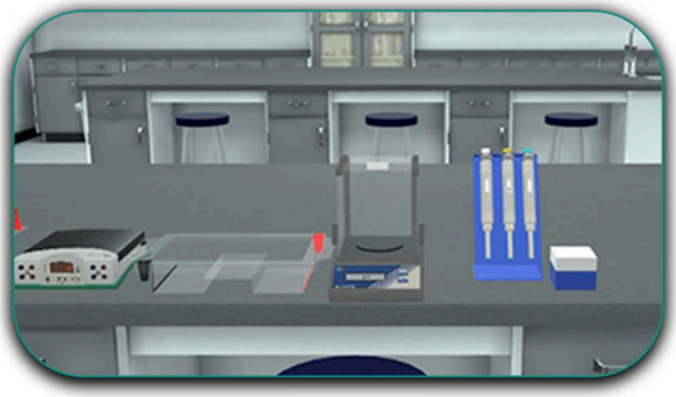
Cloning-Growth and Isolation of Plasmid DNA using Alkaline Lysis Method



Intended Learning Outcomes (ILOs)

- To apply the sterile technique while growing the bacterial culture
- To perform properly the steps of plasmid DNA isolation from bacteria using the alkaline lysis method
- To understand the role of the devices, the reagents and the enzymes used in the alkaline lysis method
- To implement proper storage of samples

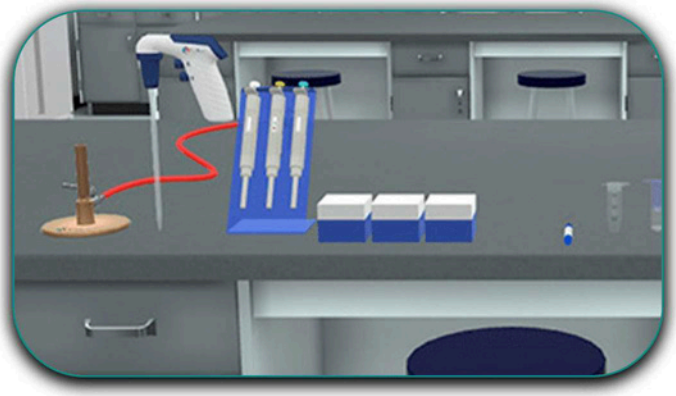
Cloning-DNA Agarose Gel Electrophoresis of Digested Plasmid and Selection for Sequencing



Intended Learning Outcomes (ILOs)

- To prepare the agarose gel properly
- To identify the concepts of gel electrophoresis
- To understand the role of the devices and the reagents used in the processes of agarose gel electrophoresis
- To load samples onto the gel
- To execute a proper run of agarose gel electrophoresis

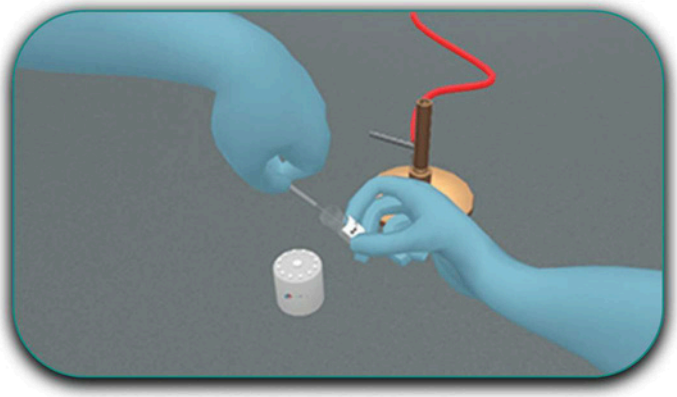
Cloning-Isolation of Sequencing Grade Plasmid



Intended Learning Outcomes (ILOs)

- To Apply the steps of high-quality DNA isolation
- To understand the role of the devices, the reagents, and the enzymes used in the process of DNA extraction
- To implement proper storage of samples

Bacterial Plating Out Technique Experiment (Streak Plate Method)



Intended Learning Outcomes (ILOs)

- Become proficient at performing streak plate method consistently and accurately
- Produce isolated colonies of an organism on an agar plate
- Identify the organism: biochemical tests to identify bacteria are only valid when performed on pure cultures

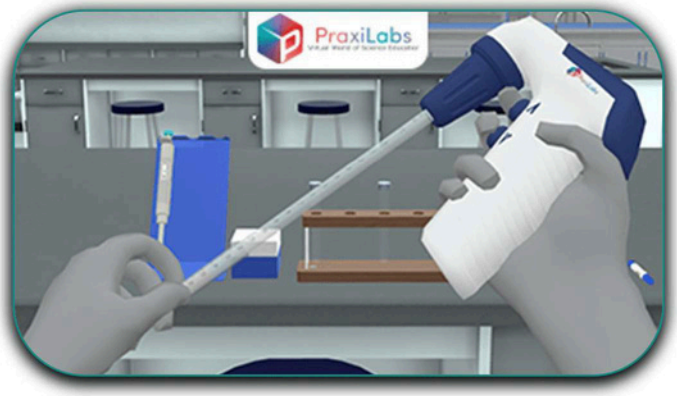
Antibiotic Sensitivity Test (Disc Diffusion Method)



Intended Learning Outcomes (ILOs)

- To utilize specific monitoring techniques to evaluate the susceptibility of a microbe to different antibiotics
- To distinguish the range of activity of an antibiotic
- To perform the test

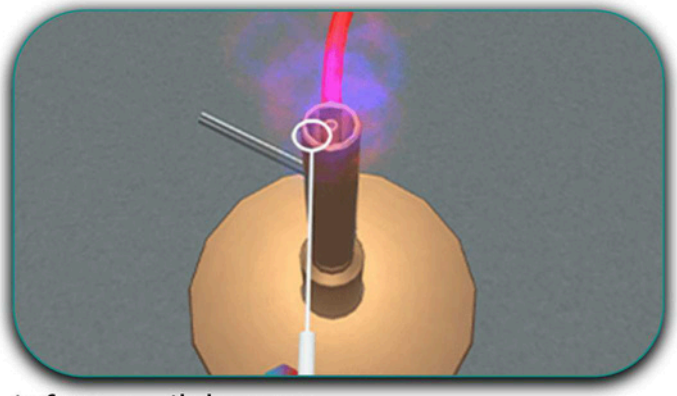
Coagulase Test



Intended Learning Outcomes (ILOs)

- To understand the biochemistry of the enzyme coagulase
- To explain how coagulase confers a survival advantage to bacteria that produce this enzyme
- To describe how pathogenic species of Staphylococci can be differentiated from nonpathogenic species
- To perform a coagulase test

Catalase Test

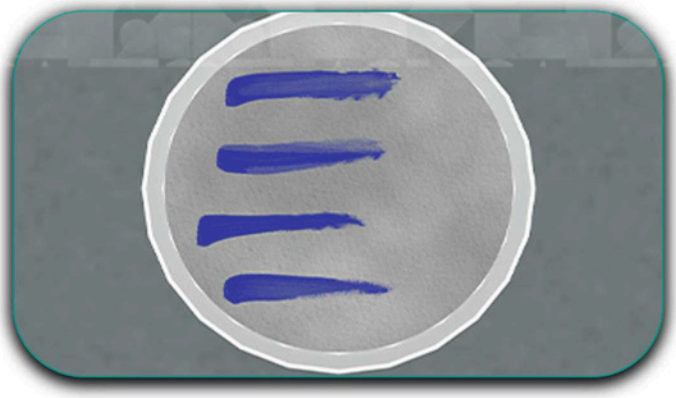


Intended Learning Outcomes (ILOs)

- To understand the biochemical process of hydrogen peroxide detoxification by aerobic bacteria through the production of the enzyme catalase
- To describe how catalase production can be determined
- To perform the test

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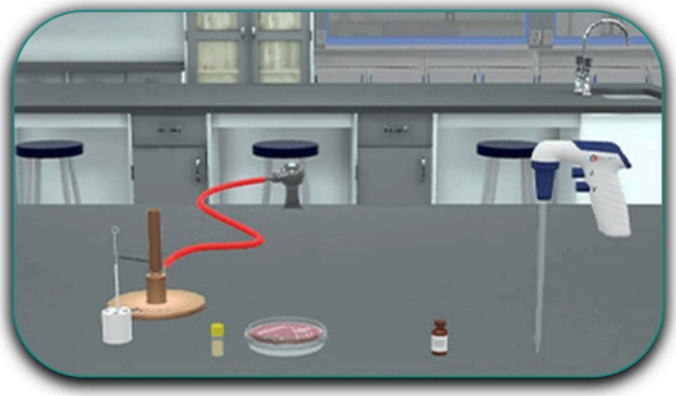
Oxidase Test



Intended Learning Outcomes (ILOs)

- Become proficient at performing the Oxidase test consistently and accurately
- Determine if an organism possesses the cytochrome oxidase enzyme
- Differentiate Neisseria, Moraxella, Campylobacter and Pasteurella species (oxidase positive) from other bacteria
- Differentiate pseudomonads from related species

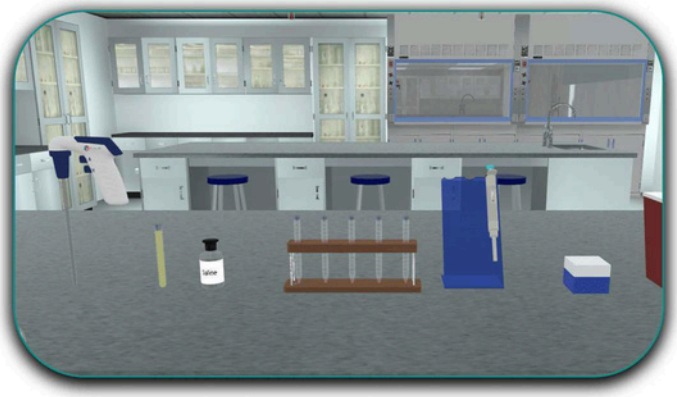
Indole Test



Intended Learning Outcomes (ILOs)

- Become proficient at performing the Indole test consistently and accurately
- Determine if an organism possesses the tryptophanase enzyme
- Differentiate Proteus mirabilis (indole negative) from all other Proteus species (indole positive)
- Differentiate Klebsiella pneumoniae (indole negative) from Klebsiella oxytoca (indole positive)
- Differentiate Citrobacter freundii (indole negative) from Citrobacter koseri (indole positive)

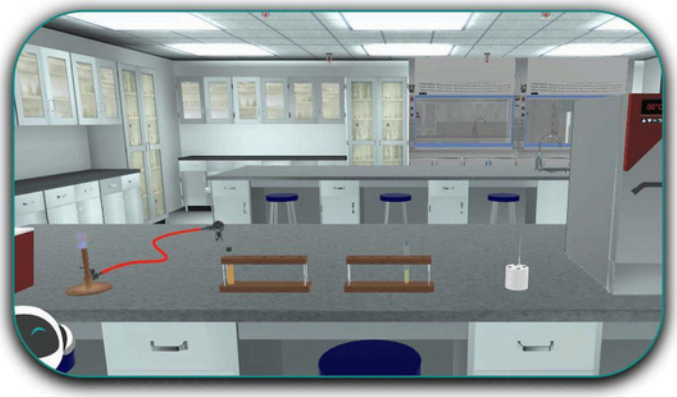
Spread Plate Technique



Intended Learning Outcomes (ILOs)

- Become proficient at performing the spread plate method consistently and accurately.
- Perform viable plate counts, in which the total number of colony-forming units on a single plate is enumerated.
- Able to calculate the concentration of cells in the tube from which the sample was plated.

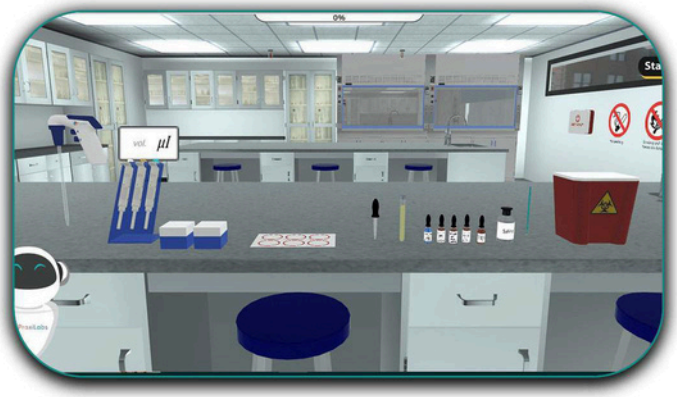
Urease test



Intended Learning Outcomes (ILOs)

- Become proficient at performing the urease test consistently and accurately.
- Differentiate between different members of lactose non-fermenting enteric microorganisms.

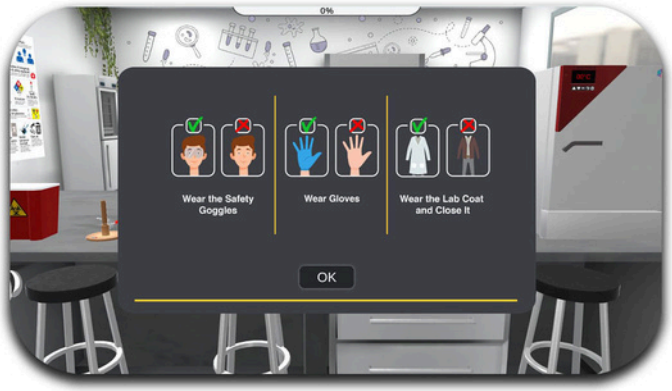
Widal Test



Intended Learning Outcomes (ILOs)

- To make a presumptive diagnosis of enteric fever, also known as typhoid fever.
- To perform the test.

Citrate Test



Learning Objectives (ILOs)

- Become proficient at performing the citrate utilization test consistently and accurately.
- Used to identify gram negative bacteria (pathogens) of environmental isolates and the Enterobacteriaceae family.

Mitosis in Onion Rings



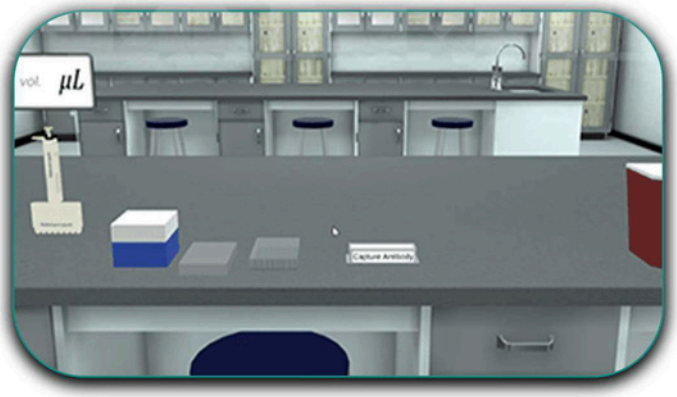
Learning Objectives (ILOs)

- Study and understand the different stages of Mitosis.
- Identify the different phases of cell division.

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Biochemistry | Immunology

ELISA Sandwich



Intended Learning Outcomes (ILOs)

- To practice the steps of a successful sandwich ELISA
- To explain the importance of the washing steps

Flow Cytometry



Intended Learning Outcomes (ILOs)

- To practice the steps of cell fixation and permeabilization
- To understand the concept of cell cycle analysis using propidium iodide

Production of Monoclonal Antibodies (mAB) – Hybridomas Technique



Intended Learning Outcomes (ILOs)

- Practice sterile cell culture techniques
- Evaluate the need to passage cells i.e. assess confluency
- Handle mice for immunization, including IV tail injection and intraperitoneal injection
- Practice serial dilution of serum
- Prepare single cell suspension out of the spleen of mice
- Perform the fusion technique using PEG
- Treat Hybridomas with HAT
- Prepare hybridomas for flow activated cell sorting FACS
- Screen hybridoma colonies for specific antibody production using ELISA

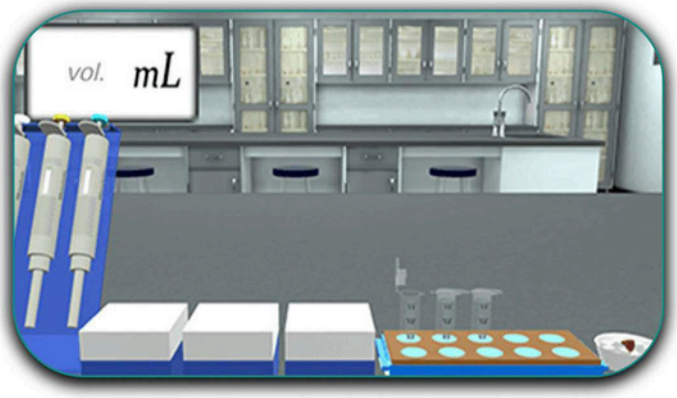
Protein Electrophoresis (Polyacrylamide Gel Electrophoresis – PAGE)



Intended Learning Outcomes (ILOs)

- Practice proper sample preparation for SDS-PAGE
- Prepare polyacrylamide gel properly
- Visualize the results of a successful protein electrophoresis run

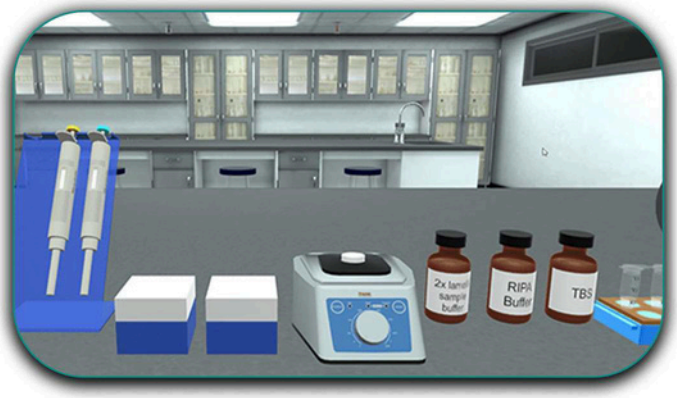
2D Protein Electrophoresis (Isoelectric Point Focusing, PAGE)



Intended Learning Outcomes (ILOs)

- To describe the techniques used in proteomics to analyze and separate proteins
- To apply general guidelines for efficient protein extraction from samples
- To understand the principle of 2D SDS PAGE protein separation
- To practice the set up required for successful iso-electric focusing
- To practice the steps of preparation of SDS PAGE and perform a run
- To visualize the end results on gel and interprete them

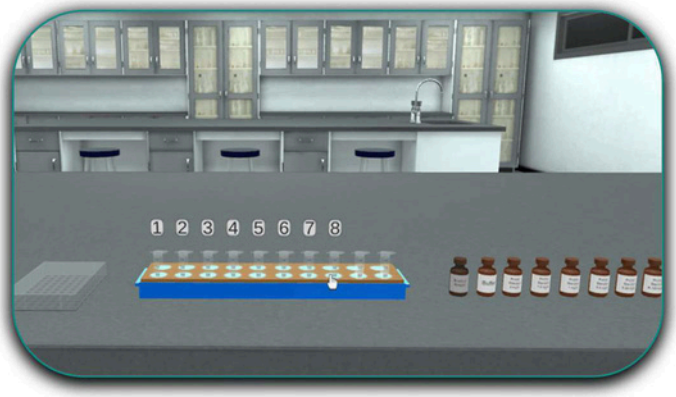
Western Blot



Intended Learning Outcomes (ILOs)

- To identify the theory behind western blot technique
- ITo fully comprehend the steps of western blot technique
- To design a complete western blot experiment
- To analyze the visualized protein

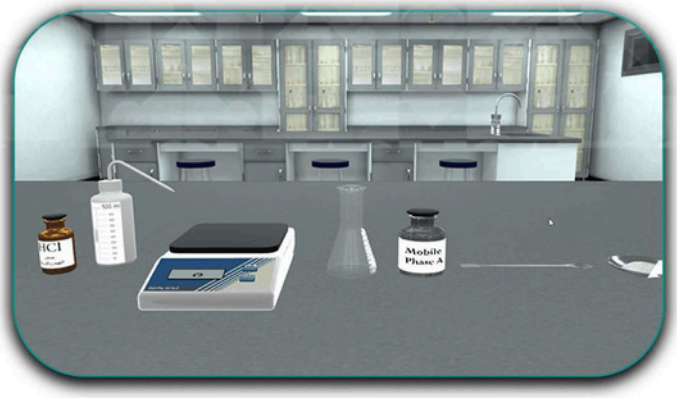
Bradford Assay



Intended Learning Outcomes (ILOs)

- Identify the amino acids that the Bradford Protein Assay measures
- Describe the color change that occurs when proteins combine with Coomassie dye under acidic conditions
- Perform serial dilutions of standard
- Illustrate the correct standard curve equation for an example BSA standard
- Interpret the standard curve equation when given example data
- Calculate the protein concentration of an example
- Recall the substance commonly used as standards in the assay and the device used to measure the color of the samples

High Performance Liquid Chromatography



Intended Learning Outcomes (ILOs)

- To prepare the mobile phase by vacuum filtration
- To prepare protein samples by acid hydrolysis prior to injection
- Perform online OPA/FMOC sample derivatization/ injection
- To list the parameters set for an HPLC run
- To visualize results of HPLC on a chromatogram

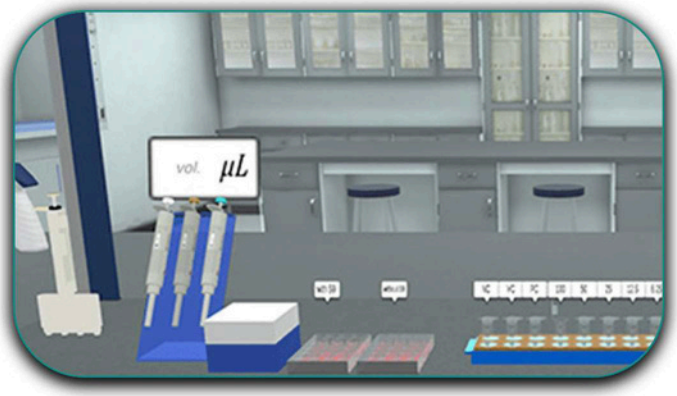
Adherent Cell Culturing using Mammalian Cell Lines



Intended Learning Outcomes (ILOs)

- Successfully handle the required instruments and consumables needed in cell culturing and subculturing
- Work and follow the general safety guidance for Good Laboratory Practice (GLP)
- Strictly work and follow the Aseptic Techniques of cell culturing
- Thaw cells from Liquid Nitrogen and seed them in cell culture flasks
- Check the confluence, harvest cells, and count them microscopically
- Scale up the cultured cells for setting up further experiments
- Freeze cells in Liquid Nitrogen for long-term storage

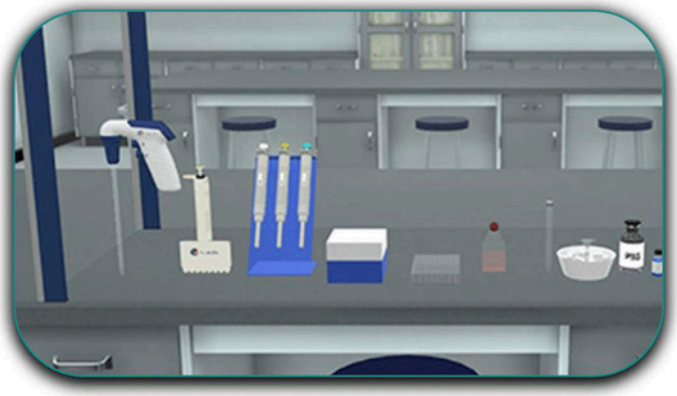
In Vitro Cytokinesis-Block Micronucleus Assay (CBMN Assay)



Intended Learning Outcomes (ILOs)

- Successfully handle the required instruments and consumables needed in the experiment
- Check the confluence and count cells under the microscope
- Dilute the cells to a specific count suitable for seeding in the 24-well plate
- Calculate the concentration of tested chemicals and prepare the calculated doses in the cell culture medium
- Treat cells with the genotoxic agent(s) or nanoparticles and observe under the microscope Harvest cells, fix them and stain with Giemsa stain
- Analyze cells by light microscope and evaluate analyzed data
- Represent and interpret the resulting data graphically using dot plots

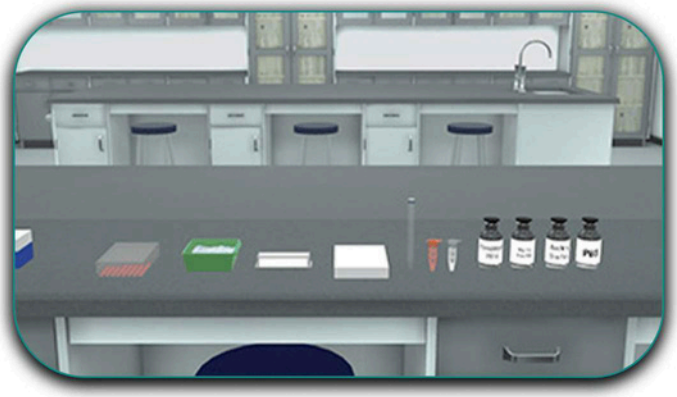
In Vitro Chromosomal Aberrations Test



Intended Learning Outcomes (ILOs)

- Successfully handle the required instruments and consumables needed in the experiment
- Check the confluence and count cells under the microscope
- Dilute the cells to a specific count suitable for seeding in the 24-well plate
- Calculate the concentration of tested chemicals and prepare the calculated doses in the cell culture medium
- Treat cells with the genotoxic agent(s) or nanoparticles and observe under the microscope Harvest cells, fix them, and stain with Giemsa stain
- Analyze cells by light microscope and evaluate analyzed data
- Represent and interpret the resulting data graphically using dot plots

In Vitro Caspase 3 Activity Assay



Intended Learning Outcomes (ILOs)

- Successfully handle the required instruments and consumables needed in the experiment
- Check the confluence and count cells under the microscope
- Dilute the cells to a specific count suitable for seeding in the 96-well plate
- Calculate the concentration of tested chemicals and prepare the calculated doses in the cell culture medium
- Treat cells with the cytotoxic agent(s) or nanoparticles and observe under the microscope
- Treatment of cells with the caspase 3 primary and secondary antibodies
- Analyze cells by fluorescent microscope and analyze resulting data
- Represent and interpret the resulting data graphically

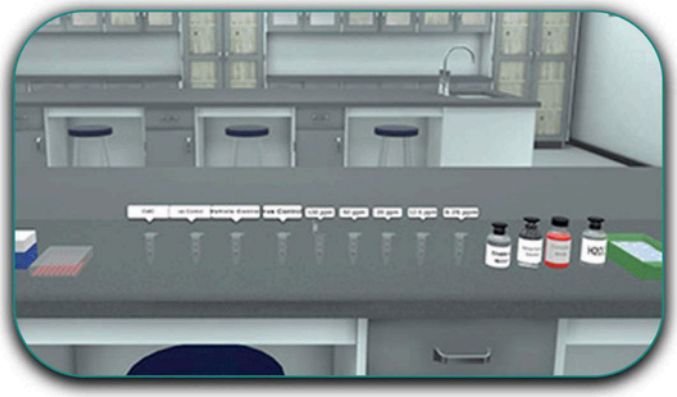
In Vitro Fluorescein Diacetate/Propidium Iodide (FDA/PI) Staining Assay



Intended Learning Outcomes (ILOs)

- Successfully handle the required instruments and consumables needed in the experiment
- Check the confluence and count cells under the microscope
- Dilute the cells to a specific count suitable for seeding in the 96-well plate
- Calculate the concentration of tested chemicals and prepare the calculated doses in the cell culture medium
- Treat cells with the cytotoxic agent(s) or nanoparticles and observe under the microscope
- Treatment of cells with the FDA/PI working solution in cell culture medium
- Count cells with bright green fluorescence (for viable cells), as well cells of bright red fluorescence (for dead cells) using fluorescence microscope
- Calculate the viability percent of viable and dead cells
- Represent the resulting data graphically and present it

In Vitro Neutral Red Uptake Assay



Intended Learning Outcomes (ILOs)

- Successfully handle the required instruments and consumables needed in the experiment
- Check the confluence and count cells under the microscope
- Dilute the cells to a specific count suitable for seeding in the 96-well plate
- Calculate the concentration of tested chemicals and prepare the calculated doses in the cell culture medium
- Treat cells with the cytotoxic agent(s) or nanoparticles and observe under the microscope
- Treatment of cells with the Neutral Red-cell culture medium
- De-stain the Neutral Red and preparing the extracted solution for analysis
- Analyze color intensity of de-stain extracts by a microplate reader and analyze resulted data
- Represent and graphically locate the IC50 of the tested nanoparticles

In Vitro Acid Phosphatase Assay for Cell Viability



Intended Learning Outcomes (ILOs)

- Successfully handle the required instruments and consumables needed in the experiment
- Check the confluence and count cells under the microscope
- Dilute the cells to a specific count suitable for seeding in the 96-well plate
- Calculate the concentration of tested chemicals and prepare the calculated doses in the cell culture medium
- Treat cells with the cytotoxic agent(s) or nanoparticles and observe under the microscope
- Treatment of cells with the Acid Phosphatase assay solution. Stopping the reaction and developing the color will be calorimetrically measured
- Analyze color intensity of the reaction by microplate reader and analyze resulted data
- Represent and graphically locate the IC50 of the tested nanoparticles

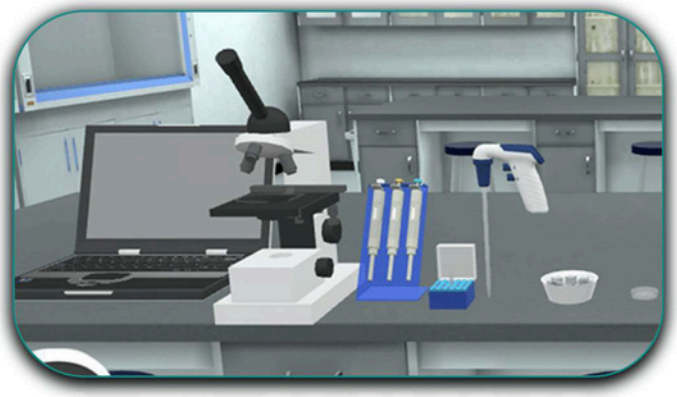
ELISpot Assay



Intended Learning Outcomes (ILOs)

- To understand the concept of ELISPOT assay
- To practice the steps of ELISPOT assay

Immunofluorescence Assay Production of Monoclonal Antibodies Experiment



Intended Learning Outcomes (ILOs)

- To understand the basic concepts of the Immunofluorescence Assay
- To apply indirect Immunofluorescence protocol
- To learn how to perform cell fixation
- To practice the 'washing technique' skill

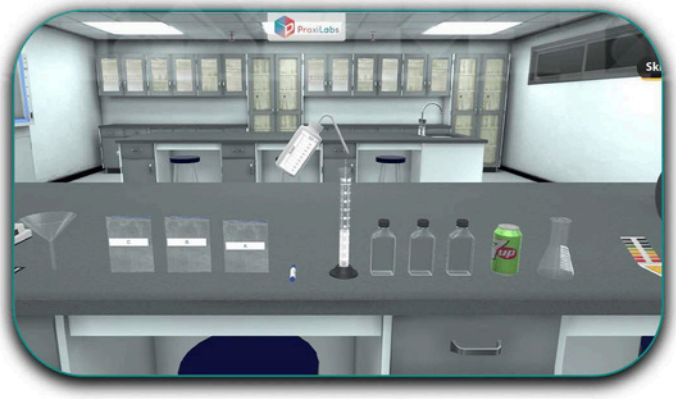
Production of Monoclonal Antibodies (mAB) – Hybridomas Technique



Intended Learning Outcomes (ILOs)

- Practice sterile cell culture techniques
- Evaluate the need to passage cells i.e. assess confluency
- Handle mice for immunization, including IV tail injection and intraperitoneal injection
- Practice serial dilution of serum
- Prepare single cell suspension out of the spleen of mice
- Perform the fusion technique using PEG
- Treat Hybridomas with HAT
- Prepare hybridomas for flow activated cell sorting FACS
- Screen hybridoma colonies for specific antibody production using ELISA

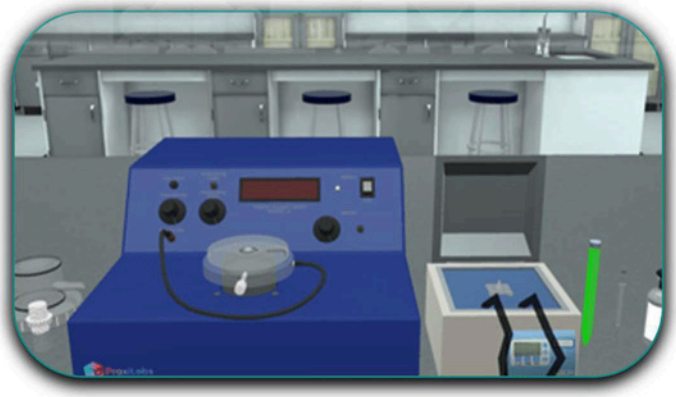
Building a Model for Catalytic Interactions



Intended Learning Outcomes (ILOs)

- The answer to the investigative questions: Why do the biochemical reactions require catalysts? What are the expected results of the experiment in the absence of enzymes in the term of speeding up or slowing down the rate of the reactions or even their occurrence?

Polarographic Oxygen Respirometry



Intended Learning Outcomes (ILOs)

- Set up a polarographic oxygen respirometry
- Run a simple biological specimen's response to both the inhibition and the uncoupling of the electron transport chain
- Collect and analyze the raw data
- Plot the data and draw informed conclusions

Molecular Biology | Genetics | Microbiology | Biochemistry | Forensic

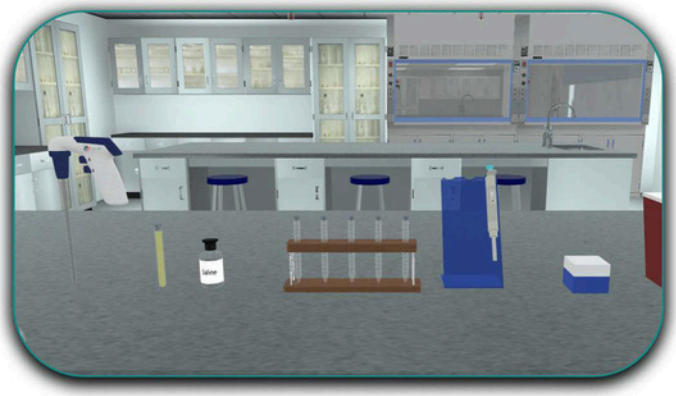
DNA Fingerprinting using Gel Electrophoresis



Intended Learning Outcomes (ILOs)

- List the steps required for the preparation of an optimum agarose gel
- Evaluate the role and value of chemicals and reagents used in the experiment
- Illustrate the setup required for gel electrophoresis
- Enlist factors that lead to successful sample upload into the gel Visualize DNA fragments
- Identify and distinguish DNA molecules that have been processed by a previous method such as PCR and enzymatic digestion
- Interpret results on a gel UV transilluminator and solve medi-co-legal cases
- Identify the characteristics of restriction sites in a DNA sequence

Spread Plate Technique



Intended Learning Outcomes (ILOs)

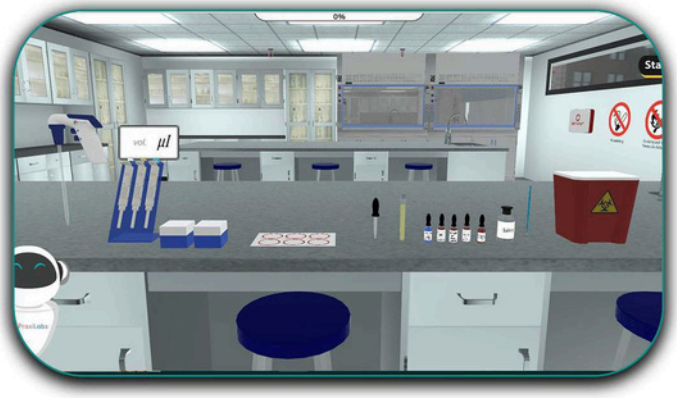
- Become proficient at performing the spread plate method consistently and accurately.
- Perform viable plate counts, in which the total number of colony-forming units on a single plate is enumerated.
- Able to calculate the concentration of cells in the tube from which the sample was plated.

Urease test



Intended Learning Outcomes (ILOs)

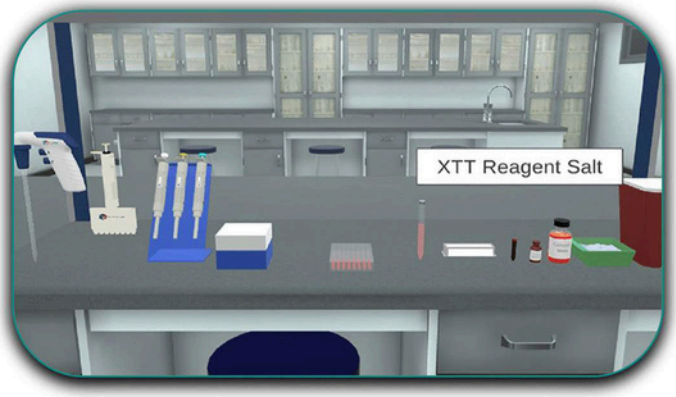
- Become proficient at performing the urease test consis-tently and accurately.
- Differentiate between different members of lactose non-fermenting enteric microorganisms.



Intended Learning Outcomes (ILOs)

- To make a presumptive diagnosis of enteric fever, also known as typhoid fever.
- To perform the test.

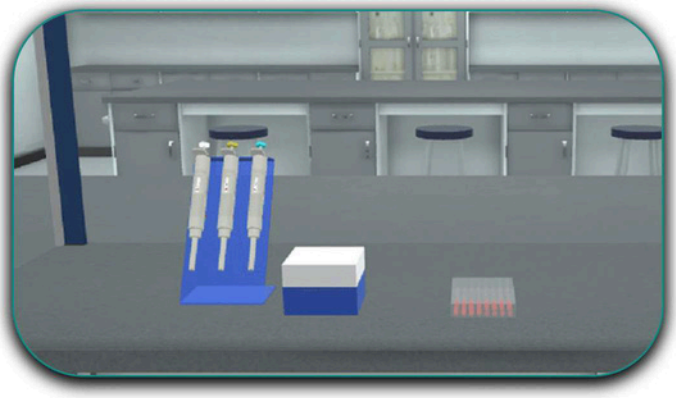
XTT Viability Assay



Intended Learning Outcomes (ILOs)

- Successfully handle the required instruments and consumables needed in the experiment
- Check the confluence and count cells under the microscope
- Dilute the cells to a specific count suitable for seeding in the 96-well plate
- Calculate the concentration of tested chemicals and prepare the calculated doses in the cell culture medium
- Aspirate the old medium and add the new medium containing the tested chemicals in the appropriate wells
- Add the XTT solution to cells and read the results using the microplate reader after incubation of cells
- Read the results of XTT and calculate the viability percent of cells exposed to different doses of tested chemical(s)

In Vitro Cell Viability by the Lactate Dehydrogenase Assay (LDH)



Intended Learning Outcomes (ILOs)

- Successfully handle the required instruments and consumables needed in the experiment
- Check the confluence and count cells under the microscope
- Dilute the cells to a specific count suitable for seeding in the 96-well plate
- Calculate the concentration of tested chemicals and prepare the calculated doses in the cell culture medium
- Aspirate the old medium and add the new medium containing the tested chemicals in the appropriate wells
- Add the LDH assay substrate solution to cells and read the results using the microplate reader after incubation of cells
- Prepare desired concentrations of LDH standard solution in cell culture medium, and draw the standard curve
- Read the results of LDH and calculate the cytotoxicity percent for cells exposed to different doses of tested chemical(s)

In Vitro Cell Viability by the Alamar Blue Assay



Intended Learning Outcomes (ILOs)

- Successfully handle the required instruments and consumables needed in the experiment
- Check the confluence and count cells under the microscope
- Dilute the cells to a specific count suitable for seeding in the 96-well plate
- Calculate the concentration of tested chemicals and prepare the calculated doses in the cell culture medium
- Aspirate the old medium and add the new medium containing the tested chemicals in the appropriate wells
- Add the Alamar Blue solution to cells and read the results using the microplate reader after incubation of cells
- Read the results of Resorufin and calculate the viability percent for cells exposed to different doses of tested chemical(s)

In Vitro Mammalian Cells COMET Assay



Intended Learning Outcomes (ILOs)

- Successfully handle the required instruments and consumables needed in the cell culturing and sub-culturing
- Work and follow the general safety guidelines for Good Laboratory Practice (GLP)
- Strictly work and follow the Aseptic Techniques of cell culturing
- Thaw cells from Liquid Nitrogen and seed them in cell culture flasks
- Check the confluence, harvest cells, and count them microscopically
- Scaling up the cultured cells for the setting of further experiments.
- Freezing cells in Liquid Nitrogen for long-term storage

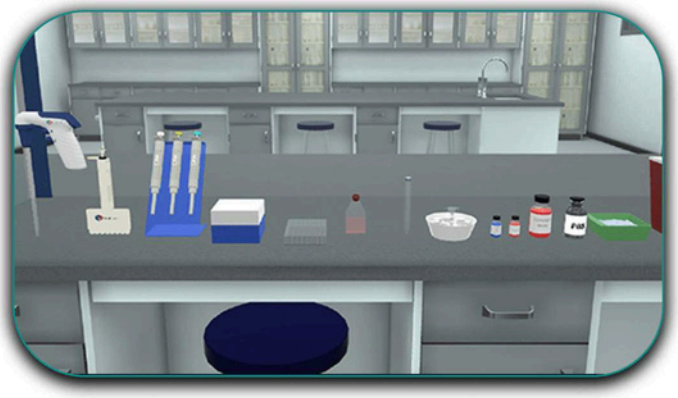
In Vitro Histone H2AX Phosphorylation Assay



Intended Learning Outcomes (ILOs)

- Successfully handle the required instruments and consumables needed in the experiment
- Check the confluence and count cells under the microscope
- Dilute the cells to a specific count suitable for seeding in the 96-well plate
- Calculate the concentration of tested chemicals and prepare the calculated doses in the cell culture medium
- Aspirate the old medium and add the new medium containing the tested chemicals in the appropriate wells
- Add the H2AX Phosphorylation assay substrate solution to cells and read the results using the fluorescent microscope after incubation of cells

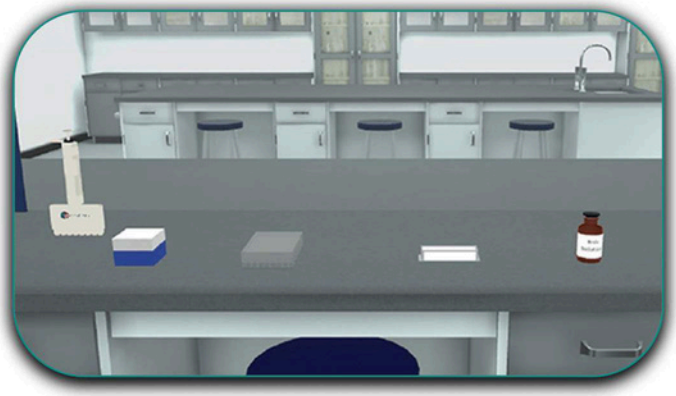
In Vitro 8OHdG DNA Adduct Assay



Intended Learning Outcomes (ILOs)

- Successfully handle the required instruments and consumables needed in the experiment
- Check the confluence and count cells under the microscope
- Dilute the cells to a specific count suitable for seeding in the 96-well plate
- Calculate the concentration of tested chemicals and prepare the calculated doses in the cell culture medium
- Aspirate the old medium and add the new medium containing the tested chemicals in the appropriate wells
- Add the blocking solution, first and secondary antibodies to cells and read the results using the fluorescent microscope after incubation of cells

In Vitro Bromodeoxyuridin BrdU Assay



Intended Learning Outcomes (ILOs)

- Successfully handle the required instruments and consumables needed in the experiment
- Check the confluence and count cells under the microscope
- Dilute the cells to a specific count suitable for seeding in the 96-well plate
- Calculate the concentration of tested chemicals and prepare the calculated doses in the cell culture medium
- Aspirate the old medium and add the new medium containing the tested chemicals in the appropriate wells
- Add the BrdU assay substrate solution to cells and read the results using the fluorescent microscope after incubation of cells with first anti-BrdU and secondary antibodies

Annexin V Assay



Intended Learning Outcomes (ILOs)

- Successfully handle the required instruments and consumables needed in the experiment
- Check the confluence and count cells under the microscope
- Dilute the cells to a specific count suitable for seeding in the 96-well plate
- Calculate the concentration of tested chemicals and prepare the calculated doses in the cell culture medium
- Treat cells with the cytotoxic agent(s) or nanoparticles and observe under the microscope
- Harvest cells with Annexin-V / Propidium Iodide buffer
- Analyze cells by fluorescent microscope and analyze resulted data. Represent and interpret the resulted data graphically using dot plots

Physiology

Amylase Test



Learning Objectives (ILOs)

- Handle the required instruments and consumables in the present experiments.
- Determine the time at which I2 solution color changes in presence of SA under different conditions.
- Determine the optimum conditions for detecting SA activity.

Red Blood Cell Count



- Handle the required instruments and consumables in the present experiments.
- Adjust the hemocytometer and assign the RBC medium squares and differentiate them from the other squares under the light microscope.
- Learn how to dilute the blood to enumerate the RBCs using a 40X lens of the light microscope.
- Calculate the total number of RBCs in the diluted blood and multiply it by the dilution factor to calculate the total number of RBCs in one milliliter of the blood.

Blood Serum Extraction



Learning Objectives (ILOs)

- Understand Safety Precautions “handling blood”.
- Recognize Different Blood Collection Tubes.
- Perform Centrifugation.
- Understand the methods and techniques used to separate serum from blood samples.

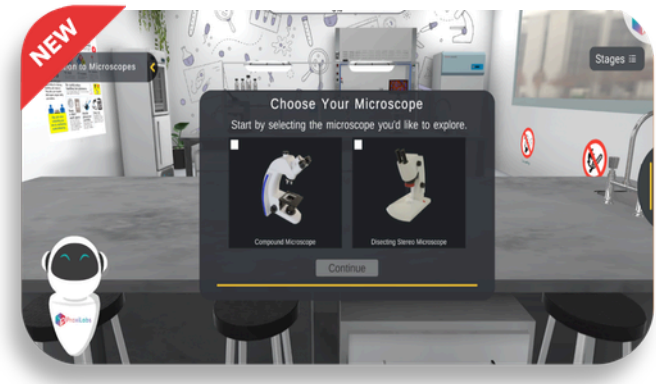
Triple Sugar Iron Test



Learning Objectives (ILOs)

- Become proficient at performing triple sugar iron biochemical reaction method consistently and accurately.
- To differentiate among members of the Enterobacteriaceae.
- To distinguish between the gram-negative enteric bacilli from other groups of intestinal bacilli based on carbohydrate fermentation and the production of hydrogen sulfide.

Introduction to Microscopes NEW



Learning Objectives (ILO):

1. Identify various microscope types.
2. Practice proper handling and use of the compound light microscope.
3. Identify the parts of a compound light microscope.
4. Prepare a wet mount slide of human cheek cells.
5. Locate and observe human cheek cells under low- and high-power magnifications using the compound microscope.
6. Understand the use of immersion oil for high-magnification observations.

Chemistry

Organic Chemistry

Inorganic Chemistry

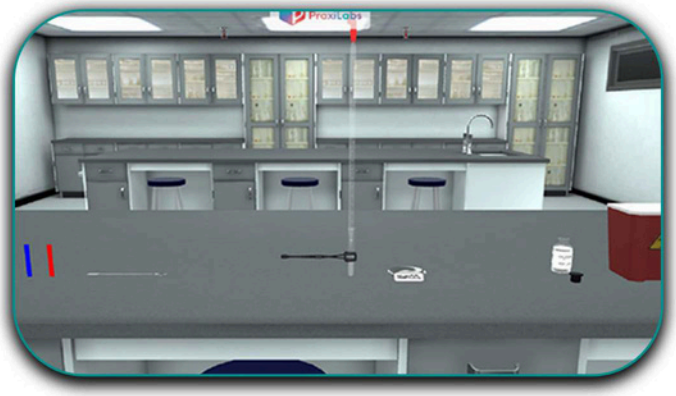
Analytical Chemistry

Acidic Radical Tests

Basic Radical Tests

Organic Chemistry

Tests for Carboxylic Group



Learning Objectives (ILOs)

- Define and determine aliphatic and aromatic carboxylic acids theoretically through their chemical structure
- Classify carboxylic acids into aliphatic and aromatic
- Compare between carboxylic acids and other organic compounds in terms of chemical structures, properties and reactions
- Identify carboxylic acids experimentally
- Select the appropriate reagents to differentiate between carboxylic acids and other organic compounds

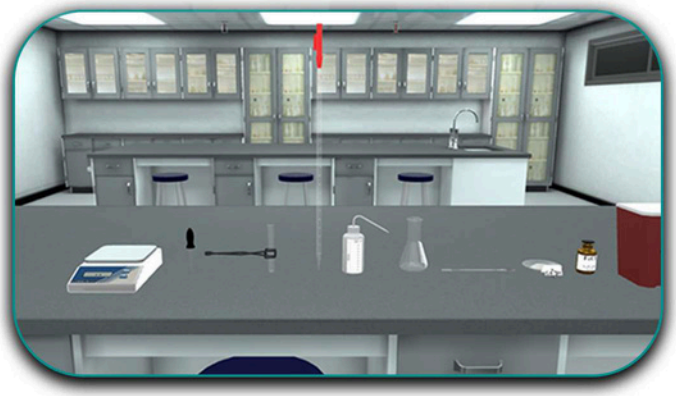
Tests for Hydroxyl Group



Learning Objectives (ILOs)

- Define and determine aliphatic alcohols theoretically through their chemical structure
- Classify organic compounds containing hydroxyl groups into aliphatic and aromatic
- Compare between alcohols and other functional groups in terms of chemical structures, properties and reactions
- Identify aliphatic alcohols experimentally
- Select the appropriate reagents to differentiate between alcohols and other organic compounds

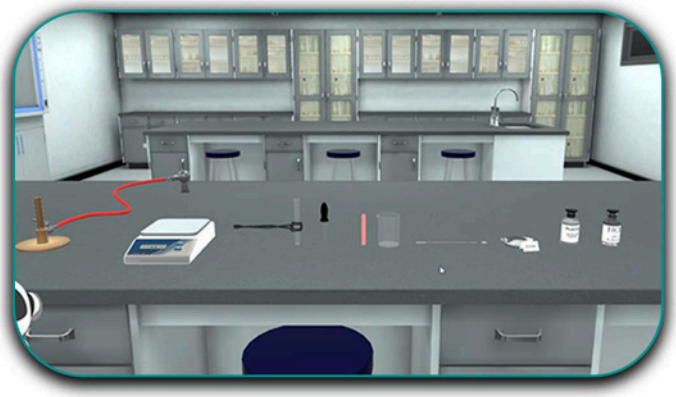
Tests for Phenolic Group



Learning Objectives (ILOs)

- Define and determine aromatic alcohols theoretically through their chemical structure
- Classify organic compounds containing hydroxyl groups into aliphatic and aromatic
- Compare between alcohols and other functional groups in terms of chemical structures, properties and reactions
- Identify aromatic alcohols experimentally
- Select the appropriate reagents to differentiate between alcohols and other organic compounds

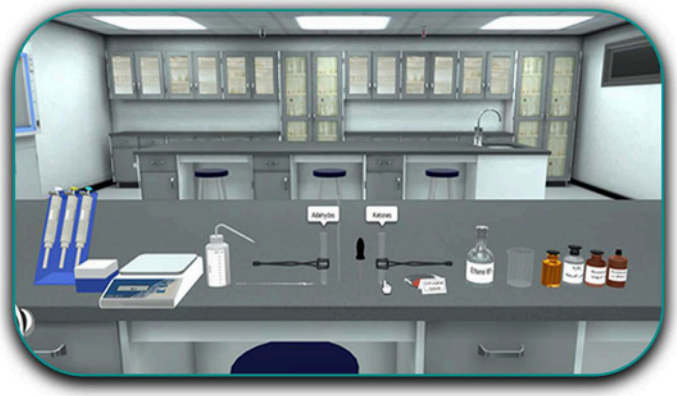
Test for Amide Group



Learning Objectives (ILOs)

- Define and determine organic compounds containing amide groups theoretically through their chemical structure
- Classify organic compounds containing amide groups into aliphatic and aromatic
- Compare between amide groups and other functional groups in terms of chemical structures, properties and reactions
- Identify amides experimentally
- Select the appropriate reagents to differentiate between amides and other organic compounds

Tests for Aldehydic and Ketonic Groups



Learning Objectives (ILOs)

- Define and differentiate between carbonyl groups of aldehydes and ketones theoretically through their chemical structure
- Classify organic compounds containing carbonyl groups into aldehydes and ketones
- Compare between aldehydes and ketones in terms of chemical structures, properties and reactions
- Select the appropriate reagents to differentiate between aldehydes and ketones
- Identify aldehydic and ketonic functional groups in organic compounds by performing 2,4-dinitrophenylhydrazine test

Diels Alder Reaction



Learning Objectives (ILOs)

- Become proficient at running organic chemical reactions
- Learning basics of organic synthesis procedures
- Understand mechanism of Diels Alder reaction
- Learn function of Diels Alder reaction Get trained on how reflux and setup of reaction is used

Synthesis of Aspirin



Learning Objectives (ILOs)

- Become proficient at running organic chemical reactions
- Learning the basics of organic synthesis procedures
- Understand the mechanism of Aspirin synthesis reaction
- Learn the function of Aspirin synthesis reaction
- Get trained on how the setup of the reaction is used

Esterification



Learning Objectives (ILOs)

Become proficient at running organic chemical reactions

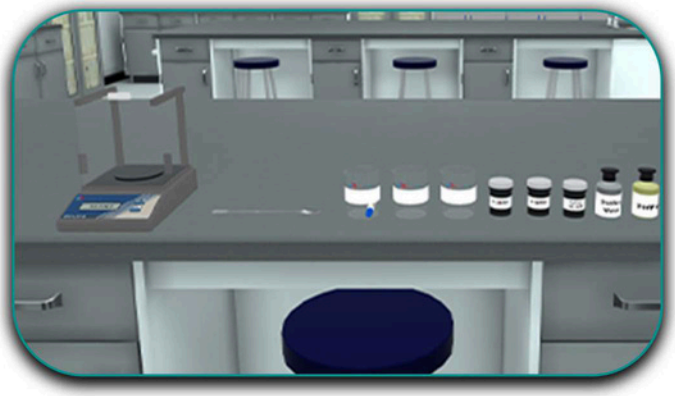
Learning basics of organic synthesis procedures

Understand the mechanism of Fischer Esterification reaction

Learn the function of Fischer Esterification reaction

Get trained on how reflux and setup of reaction is used

Electrophilic Substitution (Azo Coupling)



Learning Objectives (ILOs)

- Become proficient at running organic chemical reactions
- Learning basics of organic synthesis procedures
- Understand the mechanism of Azo coupling reaction
- Learn the function of Azo coupling reaction
- Get trained on how the reaction is used

Reaction of Alkyl Halides (Hydrolysis of Alcohols)



Learning Objectives (ILOs)

- Become proficient at running organic chemical reactions
- Learning basics of organic reaction procedures
- Understand the mechanism of alkyl halides reactions
- Learn the function of alkyl halides reaction
- Understand the difference between SN1 and SN2 nucleophilic substitution reactions
- Get trained on how the setup of the reaction is used

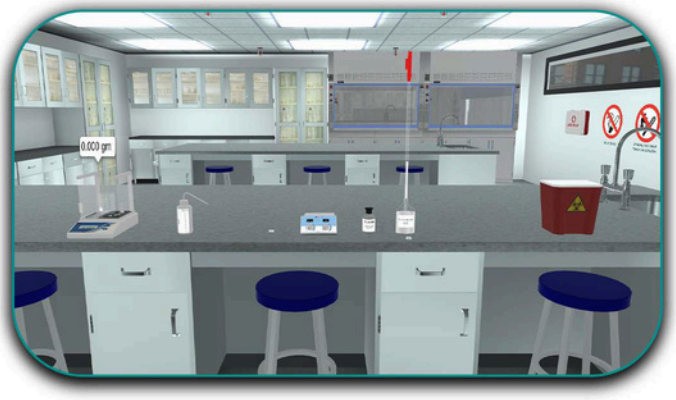
Friedel Crafts Acylation of Anisole



Learning Objectives (ILOs)

- Become proficient at running organic chemical reactions
- Learning basics of organic synthesis procedures
- Understand the mechanism of Friedel Crafts reaction
- Learn the function of Friedel Crafts reaction
- Get trained on how reflux and setup of reaction is used

Saponification Reaction



Learning Objectives (ILOs)

- Become proficient at running organic chemical reactions.
- Learning basics of organic hydrolysis procedures.
- Understand the mechanism of saponification reaction.
- Learn the function of saponification reaction
- Get trained on how the setup of reaction is used.

Preparation of β–Naphthyl Acetate



Learning Objectives (ILOs)

- Become proficient at running organic chemical reactions.
- Learning basics of the organic synthesis procedures.
- Understand the mechanism of β-naphthyl acetate synthesis reaction.
- Learn the function of β-naphthyl acetate synthesis reaction.
- Get trained on how the setup of reaction is used.

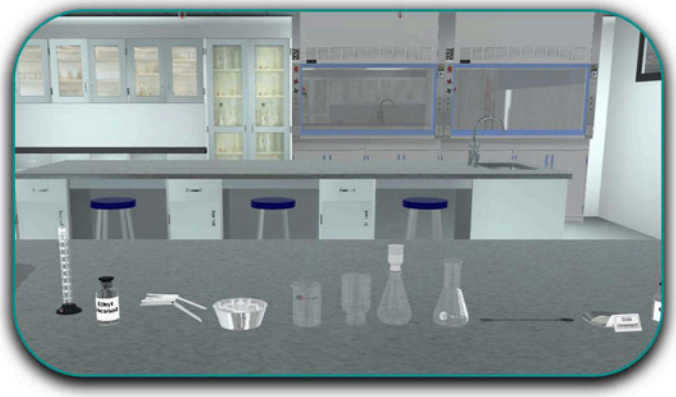
Claisen Schimdt Reaction (Mixed Aldol Condensation)



Learning Objectives (ILOs)

- Become proficient at running organic chemical reactions.
- Learning the basics of organic condensation procedures.
- Understand the mechanism of the Claisen-Schmidt condensation reaction.
- Learn the function of the Claisen-Schmidt condensation reaction.
- Understand the synthesis mechanism of dibenzalacetone.
- Get trained on how the setup of reaction is used.

Preparation of Paracetamol



Learning Objectives (ILOs)

- Become proficient at running organic chemical reactions.
- Learning basics of organic synthesis procedures.
- Understand the mechanism of paracetamol synthesis reaction.
- Learn about the function of paracetamol synthesis reaction

Grignrad Preparation



Learning Objectives (ILOs)

- Become a proficient at running organic chemical reactions.
- Learn the basics of Grignard preparation.
- Understand the mechanism of Grignard reactions.
- Learn the function of Grignard reactions.
- Get trained on how the setup of reaction is used.

Preparation of Ethyl Propionate (Propanoic acid ethyl seter) (Fisher Esterification)



Learning Objectives (ILOs)

- Become proficient at running organic chemical reactions.
- Learn the basics of organic synthesis procedures.
- Understand the mechanism of the Fischer Esterification reaction.
- Learn the function of the Fischer Esterification reaction Get trained on how reflux and setup of reaction are used.

Nitration of Methylbenzoate



Learning Objectives (ILOs)

- Become proficient at running organic chemical reactions.
- Learn the basics of organic synthesis procedures.
- Understand mechanism of electrophilic nitration reactions for aromatic rings.
- Learn function of Electrophilic substitution reactions.
- Get trained on synthetic organic chemistry techniques and skills.



Learning Objectives (ILOs)

- Perform a neutralization reaction between a weak acid and a strong base.
- Understand the chemical principles behind the FeCl3 test for carboxylic acids.
- Recognize the structure and properties of carboxylic acids.
- Compare and contrast the reactions with and without lactic acid.

Inorganic Chemistry

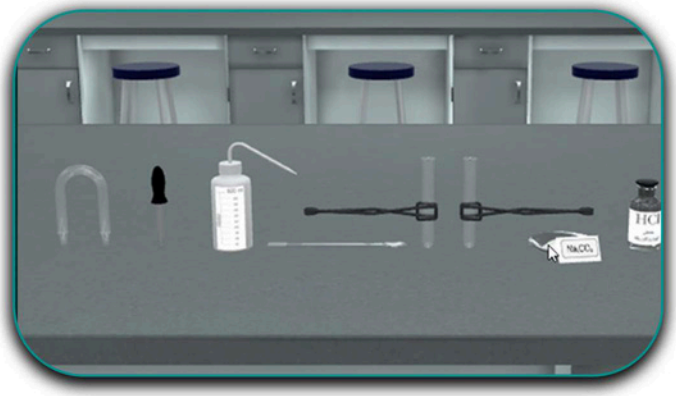
Test for Sulphite Radical



Learning Objectives (ILOs)

- Define and differentiate between sulfite ions and other acid radicals through their chemical formulas
- Classify inorganic salts according to their acid radicals
- Compare between sulfite and other first group members in terms of chemical structures, properties and reactions
- Identify sulfite radicals containing salts experimentally
- Select the appropriate reagents to detect the presence of sulfite radical

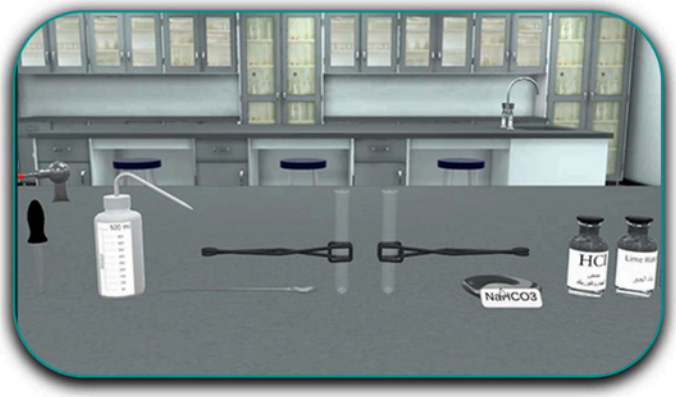
Test for Carbonate Radical



Learning Objectives (ILOs)

- Define and differentiate between carbonate ions and other acid radicals through their chemical formulas
- Classify inorganic salts according to their acid radicals
- Compare between carbonate and other first group members in terms of chemical structures, properties and reactions
- Identify carbonate radicals containing salts experimentally
- Select the appropriate reagents to detect the presence of carbonate radical
- Balance the chemical equations of chemical reactions

Test for Bicarbonate Radical

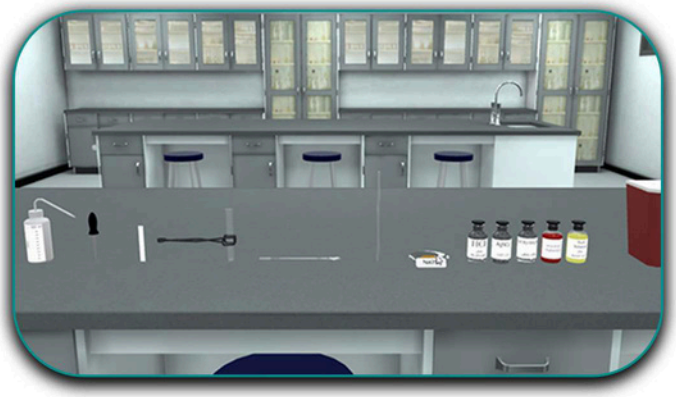


Learning Objectives (ILOs)

- Recognize bicarbonate salts in powder form or solution
- Apply the principles of safety measures
- Differentiate between carbonate and bicarbonate
- Understand various tests to identify the anion present in a given salt
- Understand the chemical reactions and their balanced equations that take place during each test
- Acquire the skill to perform the experiment in the real lab once they understand different steps in the procedure

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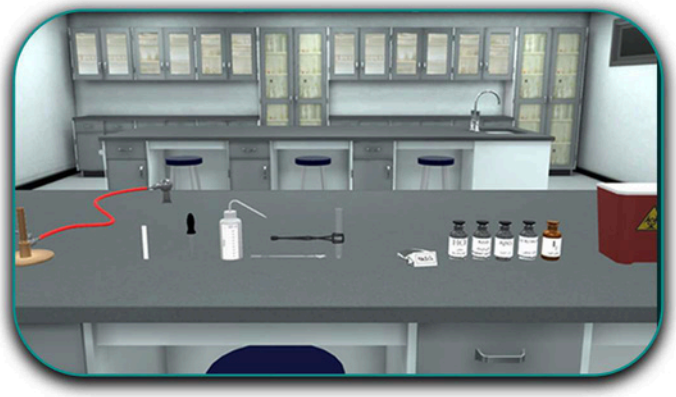
Test for Sulphide Radical



Learning Objectives (ILOs)

- Recognize sulphide salts in powder form or solution
- Apply the principles of safety measures
- Differentiate between sulphide and sulphite

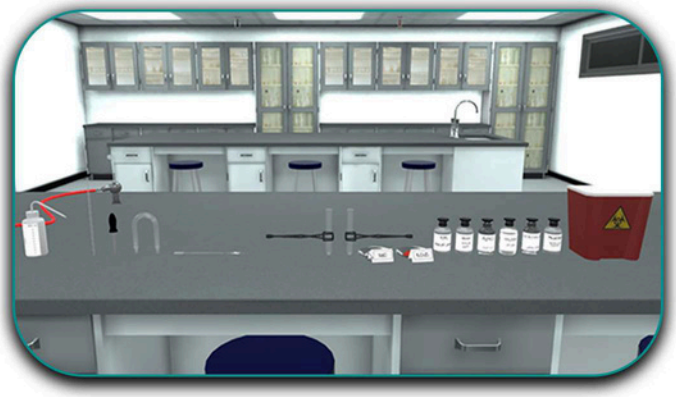
Test for Thiosulphate Radical



Learning Objectives (ILOs)

- Recognize thiosulphate salts in powder form or solution
- Apply the principles of safety measures
- Differentiate between thiosulphate and sulphate

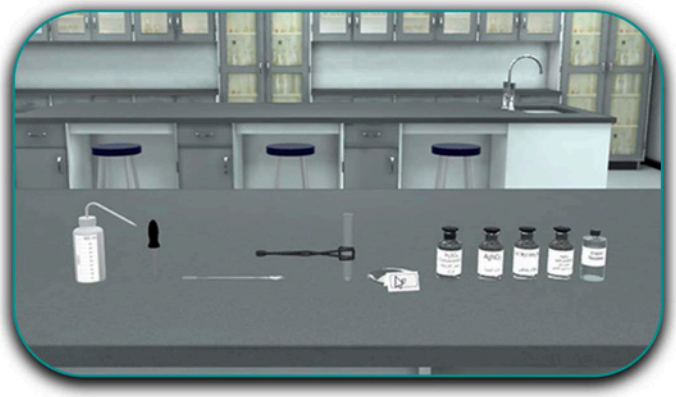
Test for Chloride Radical



Learning Objectives (ILOs)

- Define and differentiate between chloride ions and other acid radicals through their chemical formulas
- Classify inorganic salts according to their acid radicals
- Compare between chloride and other halide members in terms of chemical structures, properties and reactions
- Identify chloride radicals containing salts experimentally
- Select the appropriate reagents to detect the presence of chloride radical
- Balance the chemical equations of chemical reactions

Test for Bromide Radical



Learning Objectives (ILOs)

- Define and differentiate between bromide ions and other acid radicals through their chemical formulas
- Classify inorganic salts according to their acid radicals
- Compare between bromide and other halide members in terms of chemical structures, properties and reactions
- Identify bromide radicals containing salts experimentally
- Select the appropriate reagents to detect the presence of bromide radical

Test for Iodide Radical



Learning Objectives (ILOs)

- Define and differentiate between iodide ions and other acid radicals through their chemical formulas
- Classify inorganic salts according to their acid radicals
- Compare between iodide and other halide members in terms of chemical structures, properties and reactions
- Identify iodide radicals containing salts experimentally
- Select the appropriate reagents to detect the presence of iodide radical
- Balance the chemical equations of chemical reactions

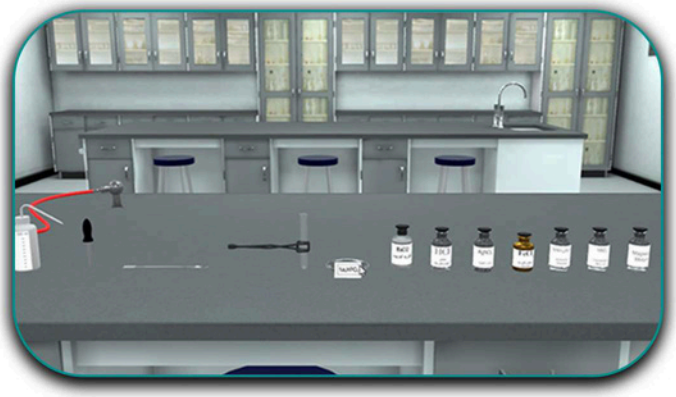
Test for Sulphate Radical



Learning Objectives (ILOs)

- Recognize sulphate salts in powder form or solution
- Apply the principles of safety measures
- Differentiate between thiosulphate and sulphate

Test for Phosphate Radical



Learning Objectives (ILOs)

- Recognize phosphate salts in powder form or solution
- Apply the principles of safety measures
- Differentiate between phosphate and Arsenate

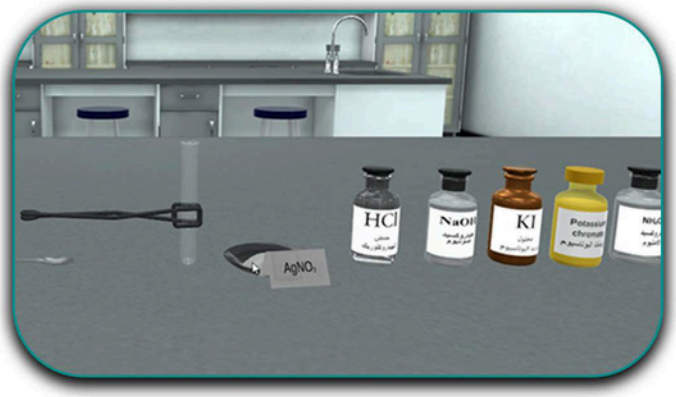
Test for Mercurous Radical



Learning Objectives (ILOs)

- Define and differentiate between members of the first group cations and those of other cation groups
- Classify inorganic salts according to their base radicals
- Compare between mercurous containing salts and other members of the same group in terms of chemical structures, properties and reactions
- Identify mercurous radicals containing salts experimentally
- Select the appropriate reagents to detect the presence of the mercurous radical
- Balance the chemical equations of chemical reactions

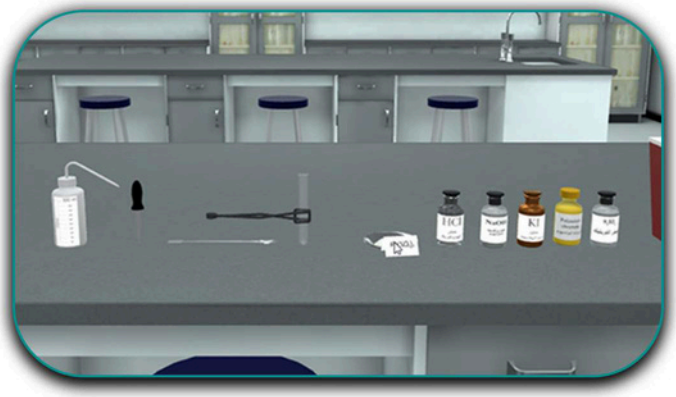
Test for Silver Radical



Learning Objectives (ILOs)

- Define and differentiate between members of the first group cations and those of other cation groups
- Classify inorganic salts according to their base radicals
- Compare between silver containing salts and other members of the same group in terms of chemical structures, properties and reactions
- Identify silver radicals containing salts experimentally
- Select the appropriate reagents to detect the presence of silver radical

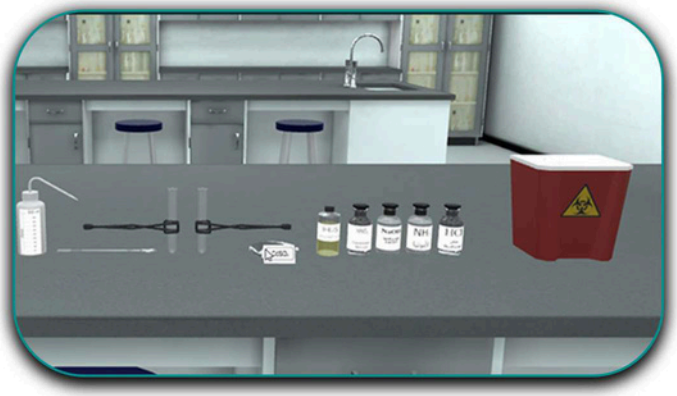
Test for Lead Radical



Learning Objectives (ILOs)

- Define and differentiate between members of the first group cations and those of other cation groups
- Classify inorganic salts according to their base radicals
- Compare between lead containing salts and other members of the same group in terms of chemical structures, properties and reactions
- Identify lead radicals containing salts experimentally.
- Select the appropriate reagents to detect the presence of lead radical
- Balance the chemical equations of chemical reactions

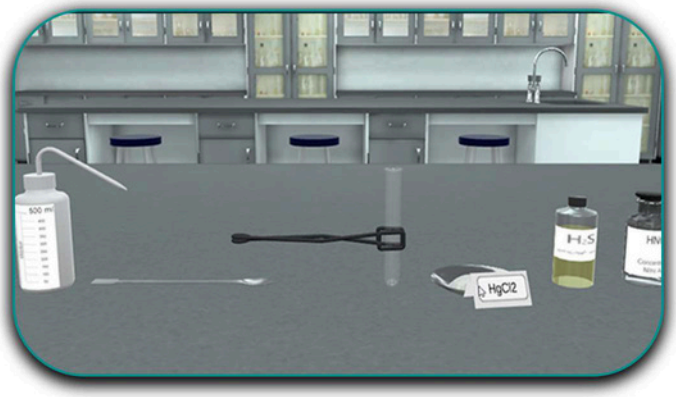
Test for Cadmium Radical



Learning Objectives (ILOs)

- Define and differentiate between members of the second group cations and those of other cation groups
- Classify inorganic salts according to their base radicals
- Compare between cadmium containing salts and other members of the same group in terms of chemical structures, properties and reactions
- Identify cadmium radicals containing salts experimentally
- Select the appropriate reagents to detect the presence of cadmium radical
- Balance the chemical equations of chemical reactions

Test for Mercuric Radical

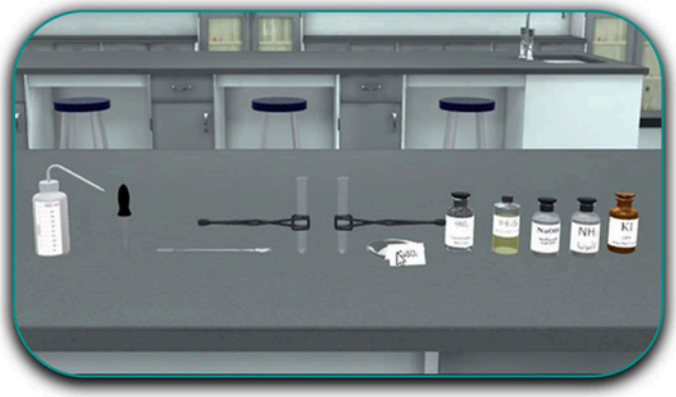


Learning Objectives (ILOs)

- Define and differentiate between members of the second group cations and those of other cation groups
- Classify inorganic salts according to their base radicals
- Compare between mercuric containing salts and other members of the same group in terms of chemical structures, properties and reactions
- Identify mercuric radicals containing salts experimentally
- Select the appropriate reagents to detect the presence of mercuric radicals
- Balance the chemical equations of chemical reactions

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Test for Cupric Radical



Learning Objectives (ILOs)

- Define and differentiate between members of the second group cations and those of other cation groups
- Classify inorganic salts according to their base radicals
- Compare between cupric containing salts and other members of the same group in terms of chemical structures, properties and reactions
- Identify cupric radicals containing salts experimentally
- Select the appropriate reagents to detect the presence of cupric radical
- Balance the chemical equations of chemical reactions

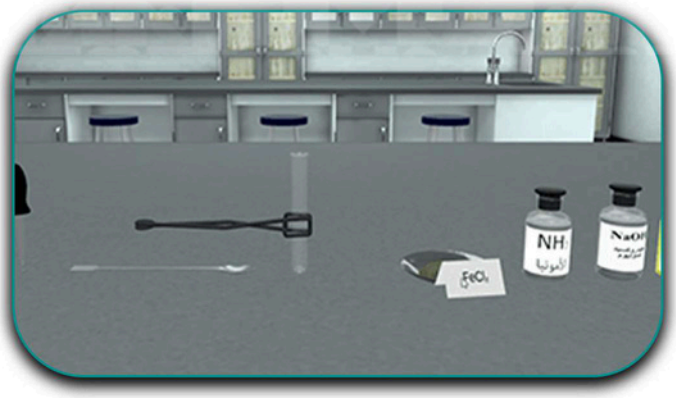
Test for Chromic Radical



Learning Objectives (ILOs)

- Define and differentiate between members of the third group cations and those of other cation groups
- Classify inorganic salts according to their base radicals
- Compare between chrome containing salts and other members of the same group in terms of chemical structures, properties and reactions
- Identify chromic radicals containing salts experimentally
- Select the appropriate reagents to detect the presence of chromic radicals
- Balance the chemical equations of chemical reactions

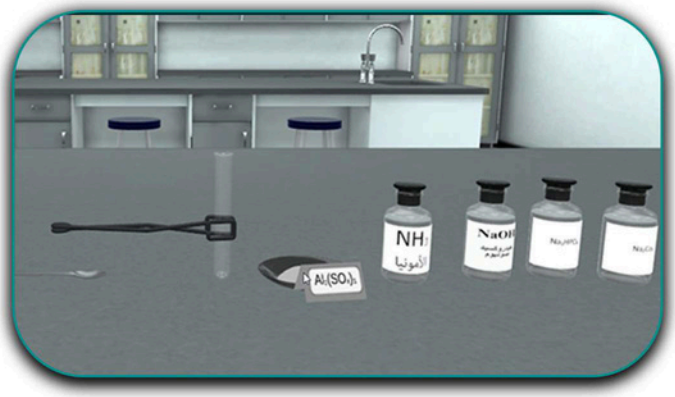
Test for Ferric Radical



Learning Objectives (ILOs)

- Recognize ferric salts in powder form or solution
- Apply the principles of safety measures
- Differentiate between ferric, chromic, and aluminum

Test for Aluminum Radical



Learning Objectives (ILOs)

- Define and differentiate between members of the third group cations and those of other cation groups
- Classify inorganic salts according to their base radicals
- Compare between aluminum containing salts and other members of the same group in terms of chemical structures, properties and reactions
- Identify aluminum radicals containing salts experimentally
- Select the appropriate reagents to detect the presence of aluminum radical

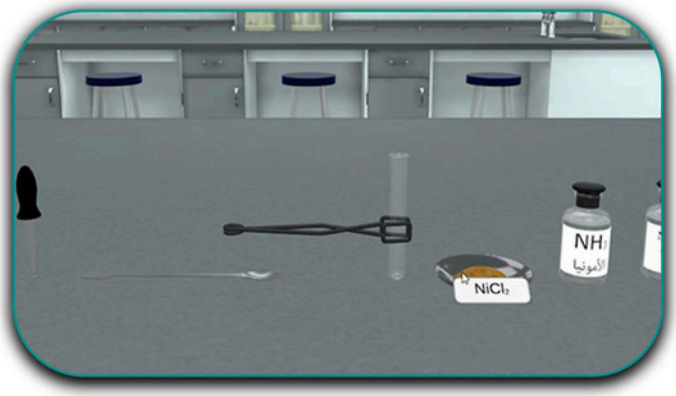
Test for Zinc Radical



Learning Objectives (ILOs)

- Define and differentiate between members of the third group cations and those of other cation groups
- Classify inorganic salts according to their base radicals
- Compare between zinc containing salts and other members of the same group in terms of chemical structures, properties and reactions
- Identify zinc radicals containing salts experimentally
- Select the appropriate reagents to detect the presence of zinc radical
- Balance the chemical equations of chemical reactions

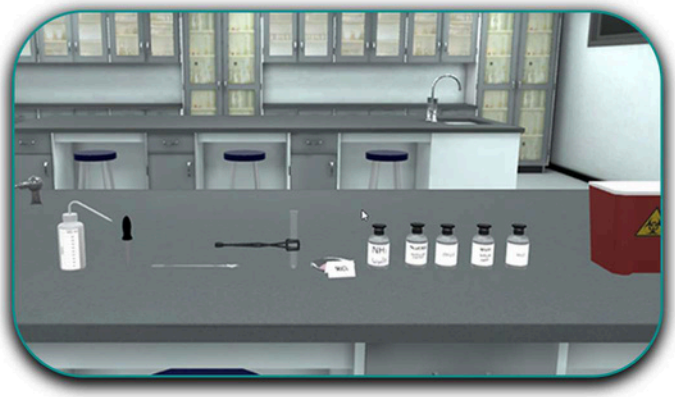
Test for Nickelous Radical



Learning Objectives (ILOs)

- Define and differentiate between members of the fourth group cations and those of other cation groups
- Classify inorganic salts according to their base radicals
- Compare between nickel containing salts and other members of the same group in terms of chemical structures, properties and reactions
- Identify nickel radicals containing salts experimentally
- Select the appropriate reagents to detect the presence of nickel radical
- Balance the chemical equations of chemical reactions

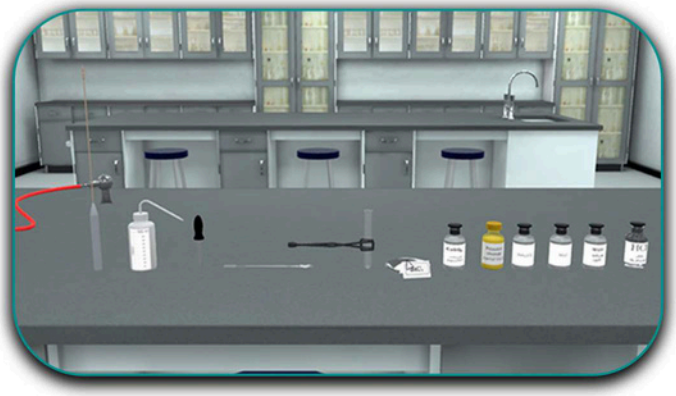
Test for Manganous Radical



Learning Objectives (ILOs)

- Define and differentiate between members of the fourth group cations and those of other cation groups
- Classify inorganic salts according to their base radicals
- Compare between manganese containing salts and other members of the same group in terms of chemical structures, properties and reactions
- Identify manganese radicals containing salts experimentally
- Select the appropriate reagents to detect the presence of manganese radical

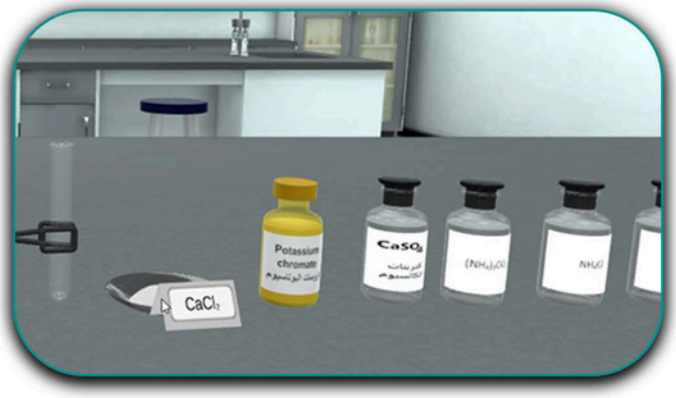
Test for Barium Radical



Learning Objectives (ILOs)

- Recognize Barium salts in powder form or solution
- Apply the principles of safety measures
- Differentiate between Barium, Calcium and strontium

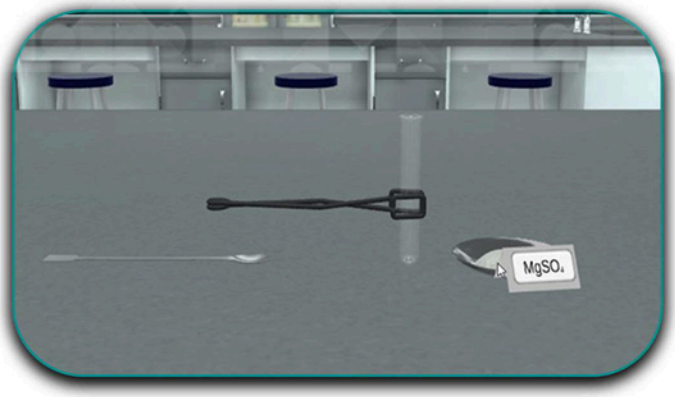
Test for Calcium Radical



Learning Objectives (ILOs)

- Define and differentiate between members of the fifth group cations and those of other cation groups
- Classify inorganic salts according to their base radicals
- Compare between calcium containing salts and other members of the same group in terms of chemical structures, properties and reactions
- Identify calcium radicals containing salts experimentally
- Select the appropriate reagents to detect the presence of calcium radical
- Balance the chemical equations of chemical reactions

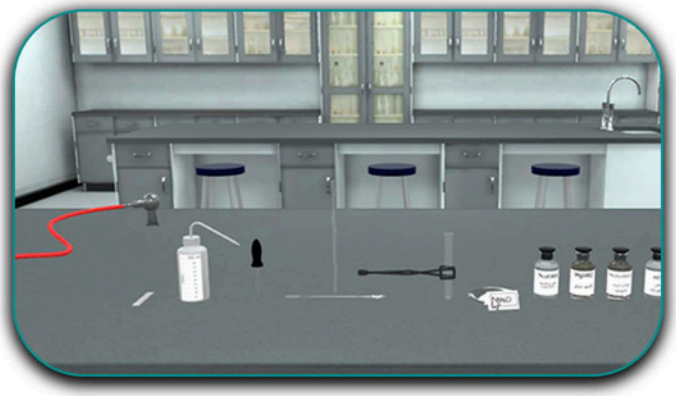
Test for Magnesium Radical



Learning Objectives (ILOs)

- Recognize magnesium salts in powder form or solution
- Apply the principles of safety measures
- Differentiate between magnesium and calcium

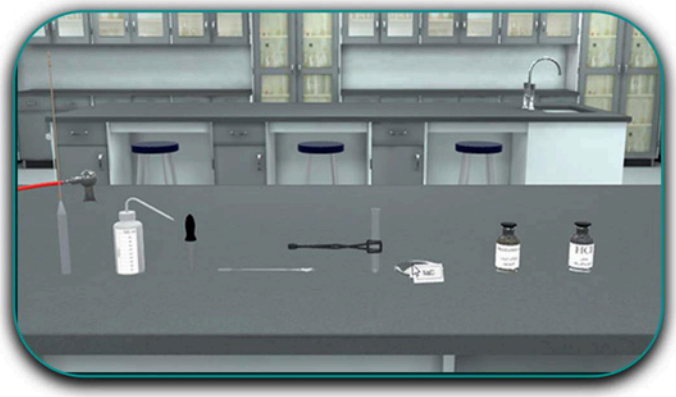
Test for Ammonium Radical



Learning Objectives (ILOs)

- Recognize ammonium salts in powder form or solution
- Apply the principles of safety measures
- Differentiate between ammonium, calcium and strontium

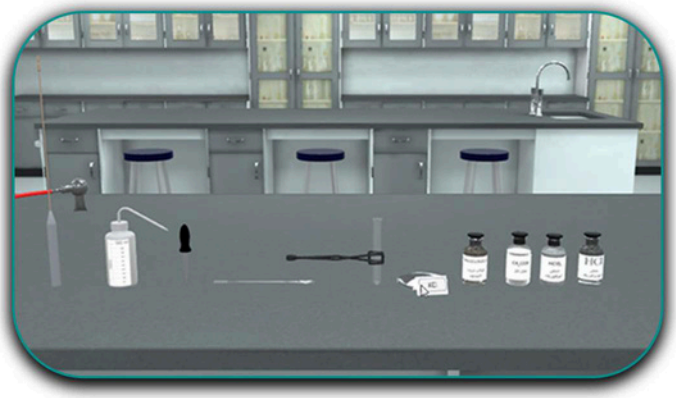
Test for Sodium Radical



Learning Objectives (ILOs)

- Define and differentiate between members of the sixth group cations and those of other cation groups
- Classify inorganic salts according to their base radicals
- Compare between sodium containing salts and other members of the same group in terms of chemical structures, properties and reactions
- Identify sodium radicals containing salts experimentally
- Select the appropriate reagents to detect the presence of sodium radical
- Balance the chemical equations of chemical reactions

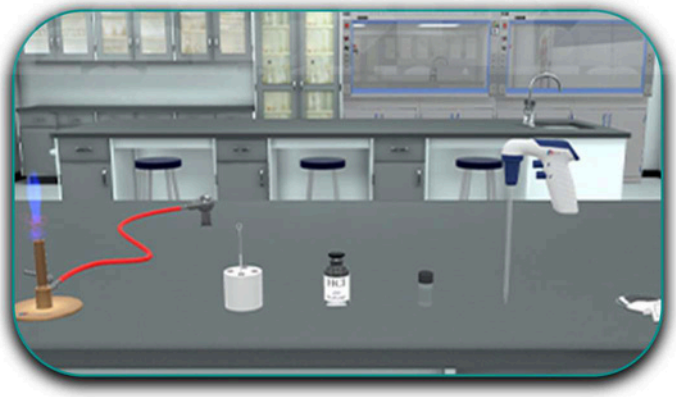
Test for Potassium Radical



Learning Objectives (ILOs)

- Define and differentiate between members of the sixth group cations and those of other cation groups
- Classify inorganic salts according to their base radicals
- Compare between potassium containing salts and other members of the same group in terms of chemica structures, properties and reactions
- Identify potassium radicals containing salts experimentally
- Select the appropriate reagents to detect the presence of sodium radical

Flame Test

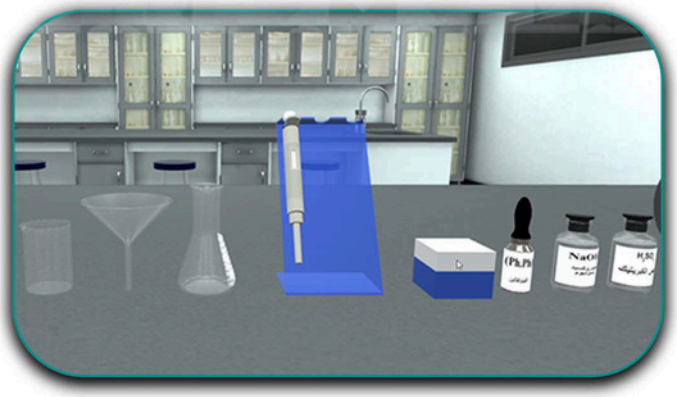


Learning Objectives (ILOs)

- Become proficient at running the identification of flame tests
- Learning basics of analytical procedures
- Understand the mechanism of flame test in electron excitation
- Learn the function of the flame test
- Get trained on the setup of flame test

Analytical Chemistry

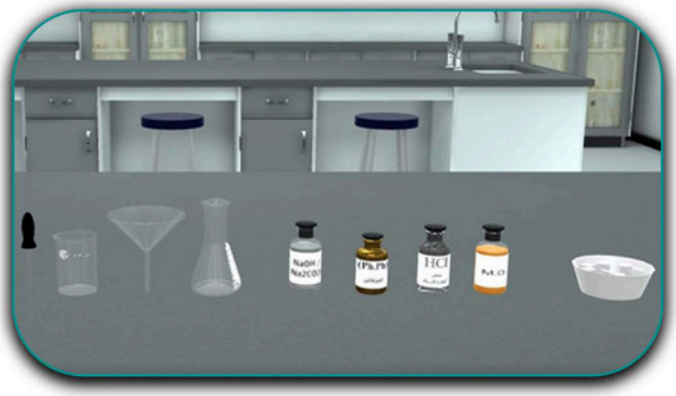
Determination of Sulphuric Acid Concentration by Titration



Learning Objectives (ILOs)

- Determine the concentration of sulphuric acid
- Acquire the correct technique of titration
- Carry out acid- base titration using phenolphthalein as indicator

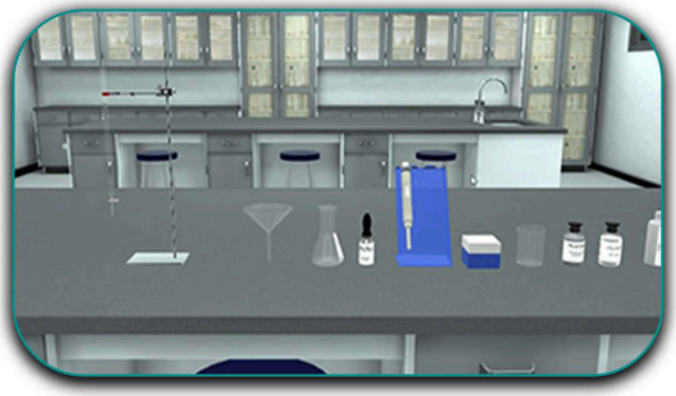
Analysis Mixture of Sodium Hydroxide and Sodium Carbonate by Warder Titration



Learning Objectives (ILOs)

- Determining the individual concentration of mixture ingredients
- Understanding the neutralization reactions
- Understanding the concept of acid base titration
- Understanding the concept of double indicator method in acid base titration

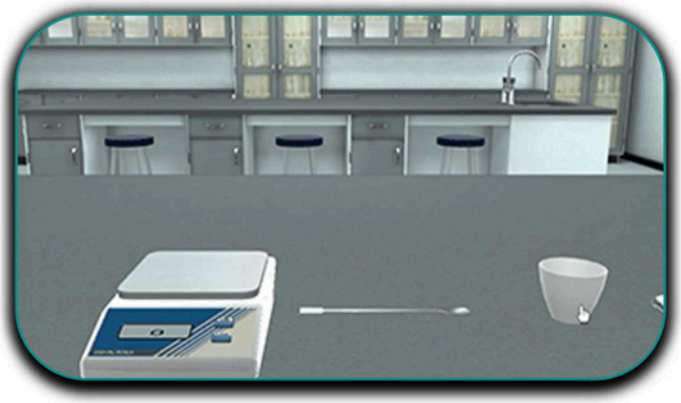
Determination of Concentration of Acetic Acid Solution in Its Commercial Vinegar Titration



Learning Objectives (ILOs)

- Identify the difference between acid and base
- Define the meaning of a standard solution
- Predict how a certain sample could be analyzed
- Determine accurately the concentration of acetic acid in vinegar via volumetric analysis, making use of the reaction of acetic acid with a strong base, sodium hydroxide
- Acquire the correct techniques of titration

Determination of Number of Particles of Water Crystallization in Borax



Learning Objectives (ILOs)

- Determine the number of particles of water of crystallization in borax

Determination of Concentration of Citric Acid in Soda by Titration



Learning Objectives (ILOs)

- Identify the difference between acid and base
- Define the meaning of a standard solution
- Predict how a certain sample could be analyzed
- Understanding the concept of acid base titration
- Understanding the neutralization reactions
- Determination of amount of citric acid in soda beverages available in the market

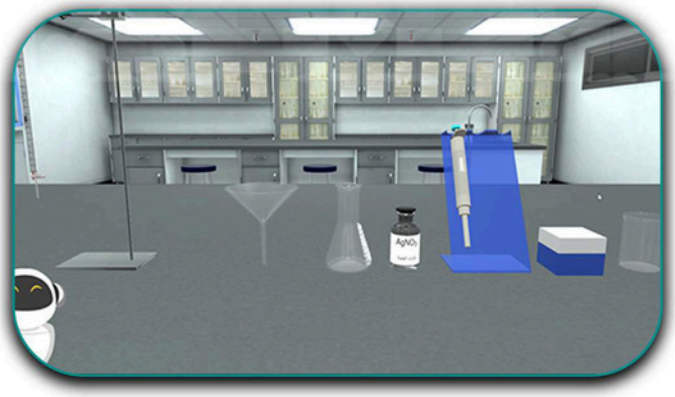
Determination of Concentration of Silver Nitrate by Fajan's Method



Learning Objectives (ILOs)

- Understand fajan's method
- Analyze silver nitrate solution by following Fajan's method
- Explain how adsorption indicators show change in color after end point

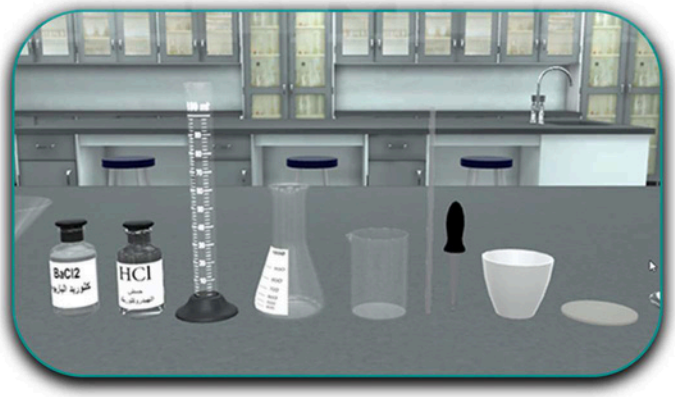
Determination of Concentration of Silver Nitrate by Mohr's Method



Learning Objectives (ILOs)

- Understands Mohr's method
- Analyze silver nitrate solution by following Mohr's method

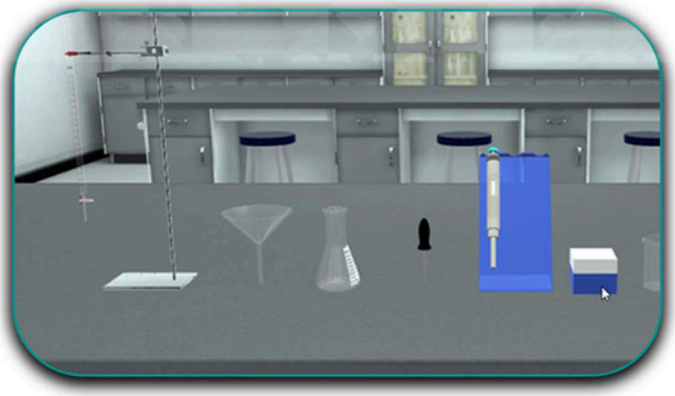
Determination of Concentration of Chlorides in Water Sample (Volhard's Method)



Learning Objectives (ILOs)

- Understand Volhard's method
- Analyze Chloride by following Volhard's method

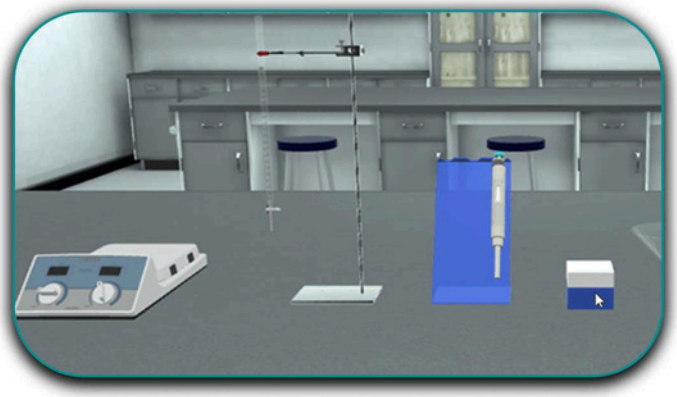
Determination of Water Hardness by Complexometric Titration



Learning Objectives (ILOs)

- Determination of concentration of total amount of calcium and magnesium salts in water
- Knowing about drawbacks of high water hardness in our real life
- Understanding the complexation reactions
- Understanding the concept of direct titration

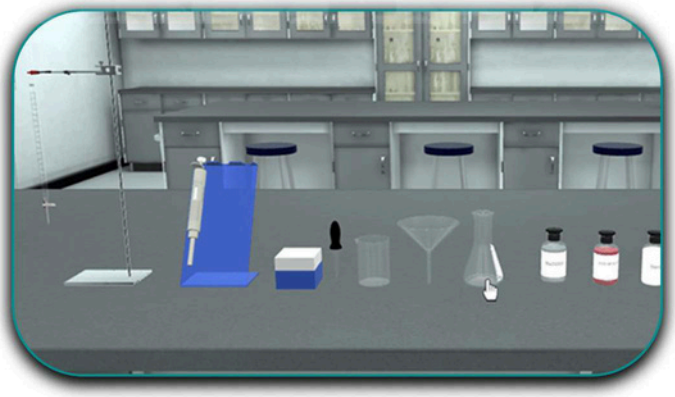
Standardization of Potassium Permanganate



Learning Objectives (ILOs)

- Define direct titration
- Define the meaning of a standard solution
- Differentiate between primary and secondary standards
- Predict how a certain sample could be analyzed
- Determine the strength of potassium permanganate with a standard oxalic acid solution
- Perform titration with the control of the temperature
- Calculate the molarity and the strength of a given standard based on a similar procedure

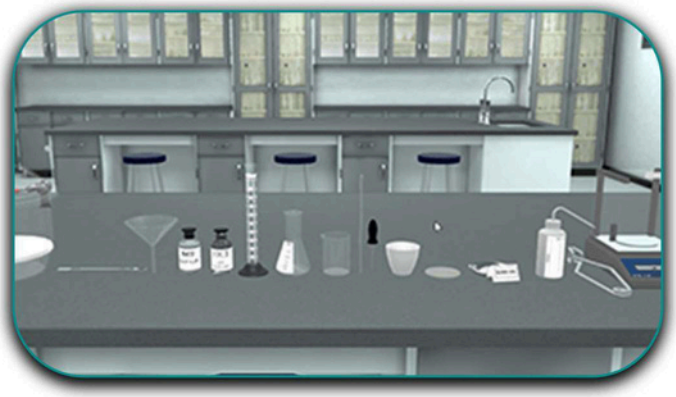
Standardization of Sodium Thiosulphate using Iodimetric Titration



Learning Objectives (ILOs)

- Standardization of a prepared solution of sodium thiosulphate
- Understanding the difference between iodometry and iodimetry
- Understanding the concept of iodometry
- Understanding the concept of redox reactions

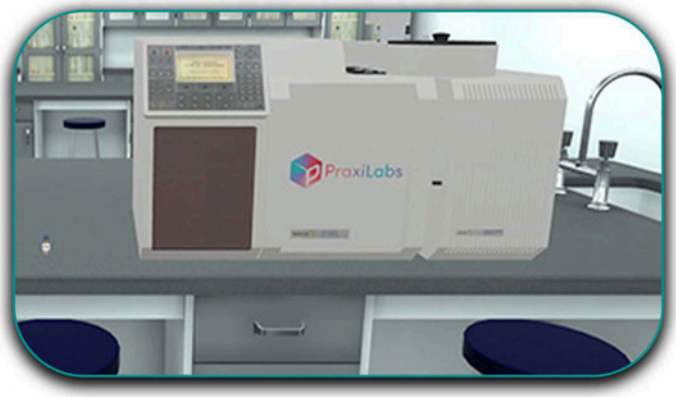
Gravimetric Analysis of Sulphate



Learning Objectives (ILOs)

- Explain the principle of gravimetry
- Enumerate the steps of gravimetry
- To learn the techniques associated with gravimetric analysis
- To use stoichiometry to calculate the percentage by mass of sulfate in an unknown sulfate salt
- Propose a gravimetric method for the analysis of different salts based on knowledge gained from this experiment

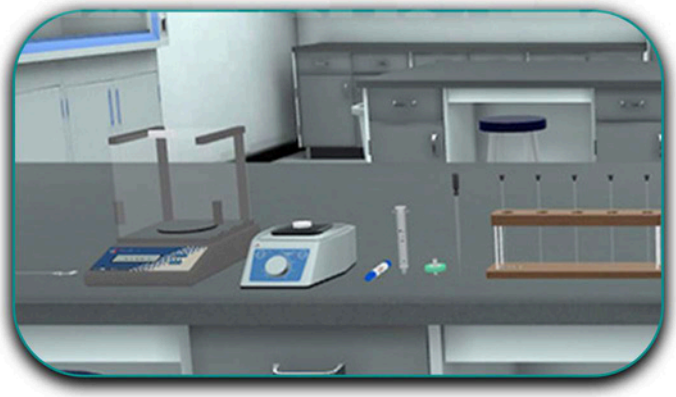
GC/MS Analysis



Learning Objectives (ILOs)

- Become proficient at basic concepts of water samples analysis
- Learning basics of chromatographic techniques
- Understand mechanism of operation of GC/MS
- Learn functions of GC and MS in water sample analysis
- Get trained on using the instruments and their software

NMR Analysis



Learning Objectives (ILOs)

- Become proficient at basic concepts of chemical characterization of chemical compounds
- Learning basics of spectrometry techniques
- Understand mechanism of operation of proton NMR
- Learn functions of NMR in chemical compounds analysis

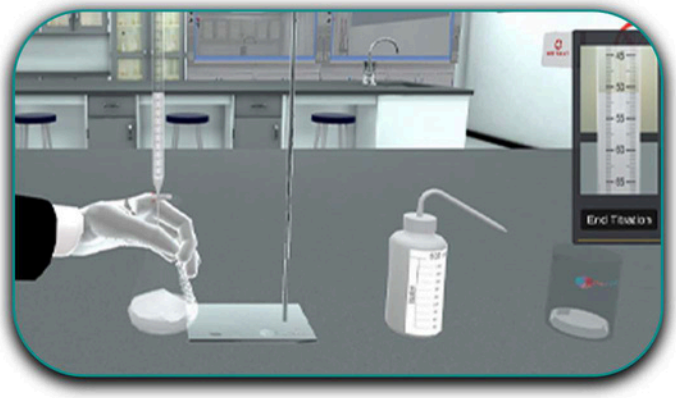
IR Analysis



Learning Objectives (ILOs)

- Become proficient at basic concepts of chemical characterization of chemical compounds
- Learning basics of spectrometry techniques
- Understand mechanism of operation of FTIR
- Learn functions of FTIR in chemical compounds analysis
- Get trained on using the FTIR and its software
- Get trained on using the instruments and their software

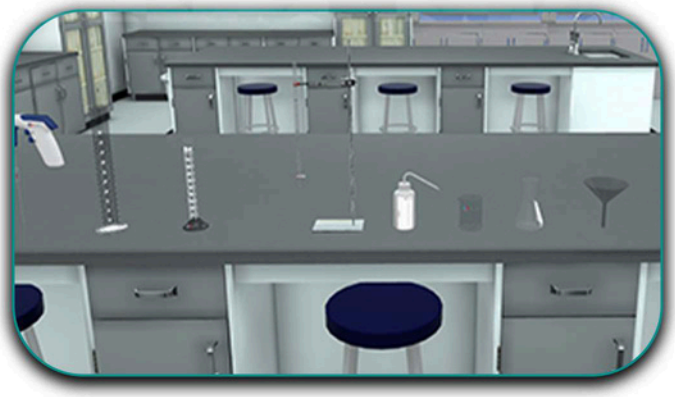
Strong Acid/Strong Base Titration (HCl/NaOH)



Learning Objectives (ILOs)

- Gain the knowledge of how acids and bases will react if their formulas are known
- Understand the titration concept
- Standardize an aqueous solution of sodium hydroxide to be used as the titrant
- Calculate the concentration of an unknown strong acid given the amount of base necessary to titrate it
- Use titration data or a titration curve to calculate reaction quantities such as the concentration of the substance being titrated

Weak Base/Strong Acid Titration



Learning Objectives (ILOs)

- Gain the knowledge of how acids and bases will react if their formulas are known
- Understand the titration concept
- Standardize an aqueous solution of hydrochloric acid to be used as the titrant
- Calculate the concentration of an unknown weak base given the amount of acid necessary to titrate it
- Use titration data or a titration curve to calculate reaction quantities such as the concentration of the substance being titrated

Aspirin titration (Weak Acid / Strong Base Titration)



Learning Objectives (ILOs)

- Become proficient at carrying out titrations.
- Learn the basics of analytical procedures.
- Understand the mechanism of back acid-base titrations.
- Learn the function of titrations as analytical methods.
- Get trained on the setup of titration experiments.

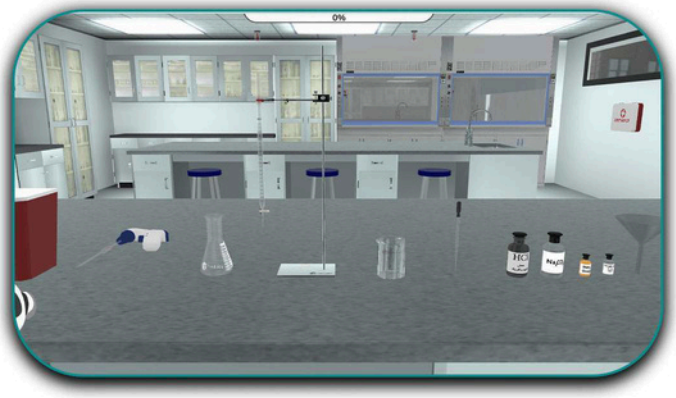
Determining the percent of citric acid in apple juice



Learning Objectives (ILOs)

- Identify the difference between acids and bases.
- Determine the meaning of the standard solution.
- Predict how a specific sample could be analyzed.
- Understanding the neutralization reactions.
- Understanding the concept of acid-base titration.
- Determine the amount of citric acid in apple juices available in the market.

Determining the Molarity of HCl Solution By a Standard Solution of Sodium Carbonate Using Phenolphthalein and Methyl Orange as pH Indicators



Learning Objectives (ILOs)

- Gain knowledge of how acids and bases will react if their formulas are known.
- Understand the titration concept.
- Understand the difference in the concept of phenolphthalein and methyl orange indicators.
- Calculate the concentration of an unknown strong acid, by giving the amount of Na2CO3 necessary to titrate it.

Determining the Molarity of NaOH Solution by a Standard Solution of HCl Using Two different pH Indicators Phenolphthalein and Methyl Orange



Learning Objectives (ILOs)

- Determine the individual concentration of mixture ingredients.
- Determine the purity of the sample.
- Detecting impurities in the sample.
- Understanding the neutralization reactions.
- Understanding the concept of acid-base titration.
- Understanding the concept of the double indicator method in acid-base titration.

Acidic Radical Tests

Learning Objectives (ILOs)

- Students understand various tests to identify the anion present in a given salt.
- Students understand the chemical reactions that take place during each test.
- Students acquire the skill to perform the experiment in a real lab once they understand the different steps in the procedure.

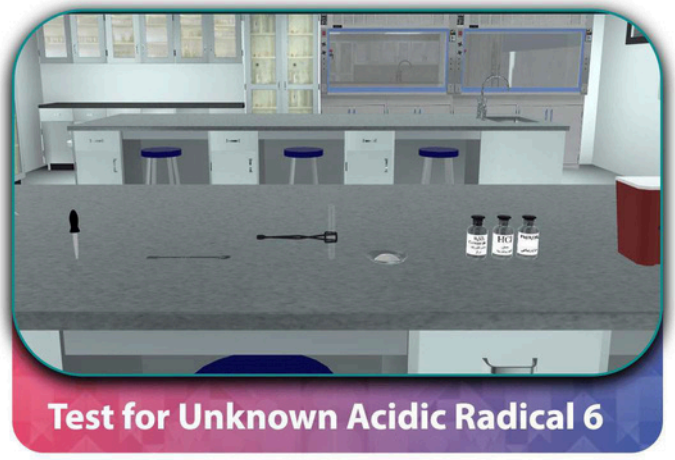


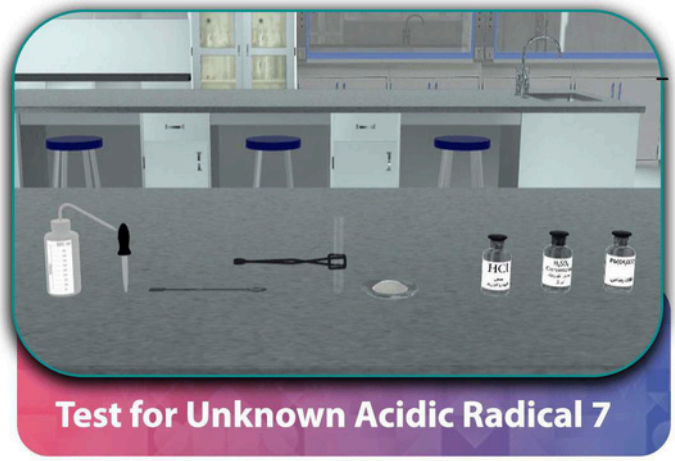




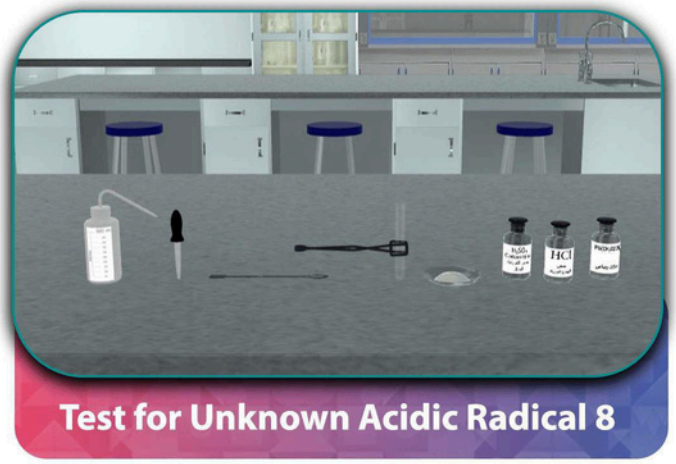








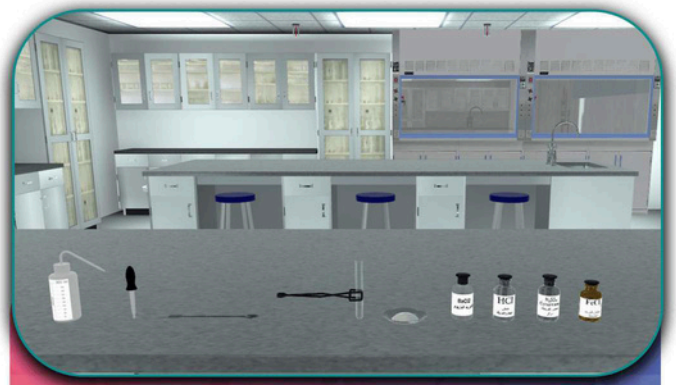
Test for Unknown Acidic Radical 7



Test for Unknown Acidic Radical 8



Test for Unknown Acidic Radical 9

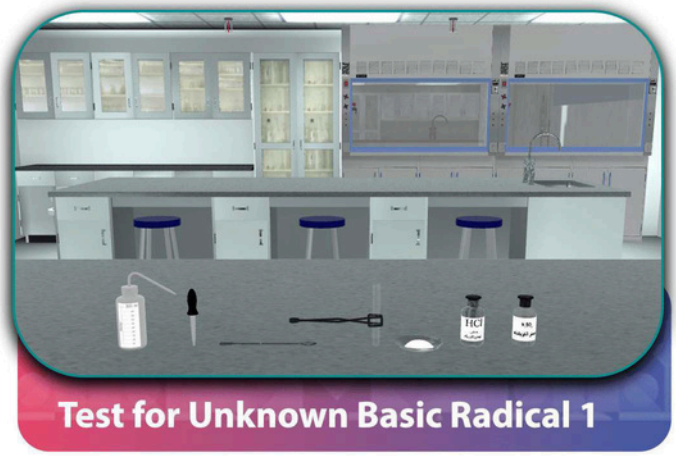


Test for Unknown Acidic Radical 10

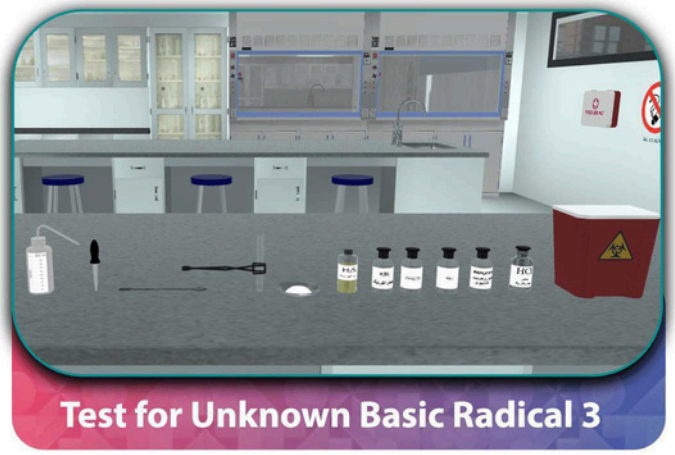
Basic Radical Tests

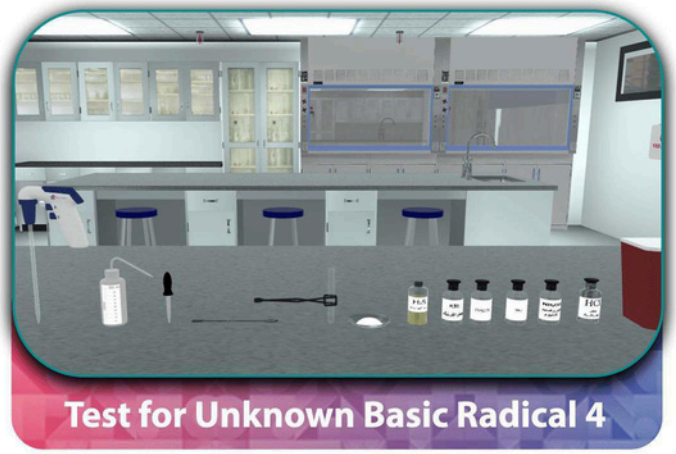
Learning Objectives (ILOs)

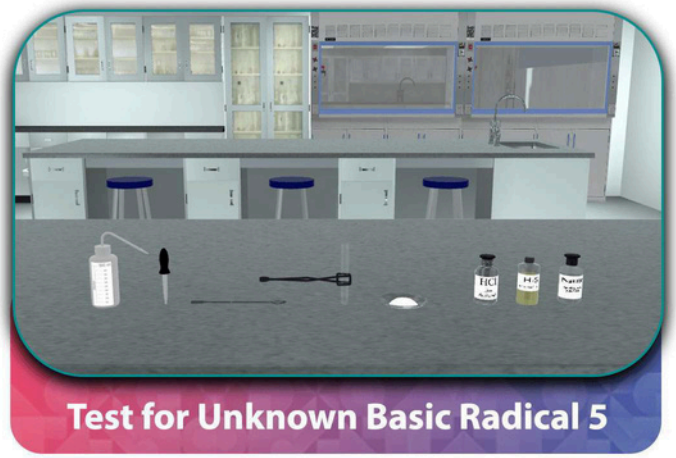
- Students understand various tests to identify the cation present in a given salt.
- Students understand the chemical reactions that take place during each test.
- Students acquire the skill to perform the experiment in a real lab once they understand the different steps in the procedure.











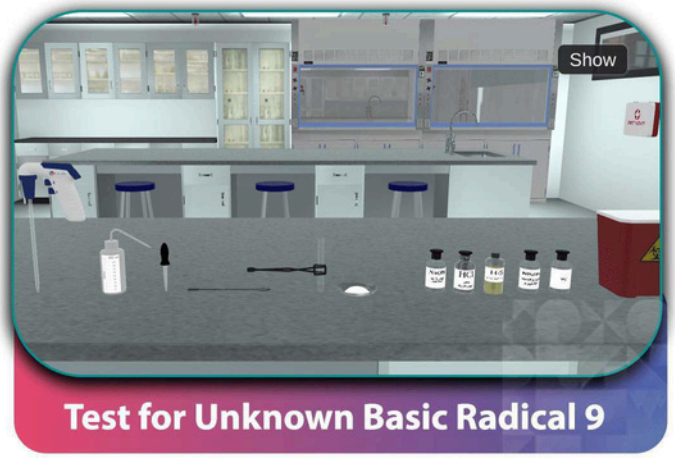




Test for Unknown Basic Radical 7



Test for Unknown Basic Radical 8



Test for Unknown Basic Radical 9



Test for Unknown Basic Radical 10



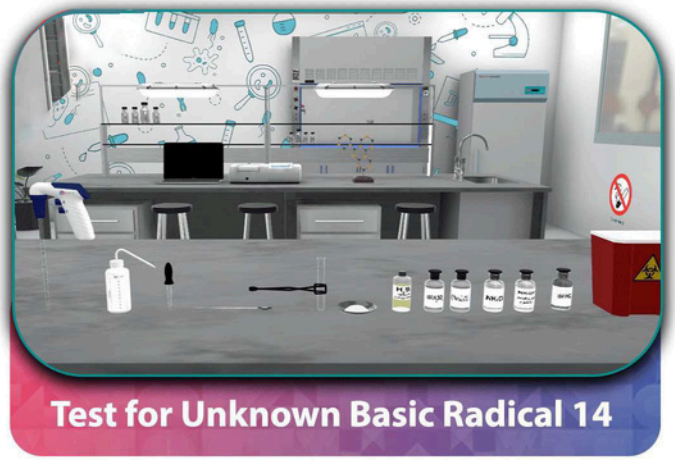
Test for Unknown Basic Radical 11



Test for Unknown Basic Radical 12



Test for Unknown Basic Radical 13



Test for Unknown Basic Radical 14


Test for Unknown Basic Radical 15


Test for Unknown Basic Radical 16


Test for Unknown Basic Radical 17


Test for Unknown Basic Radical 18

Electrochemistry

Determination of the Standard Electrode Potential of Silver Electrode NEW



Learning Objectives (ILO):

1. Understand the concept of standard electrode potential.
2. Learn how to set up a galvanic cell using a standard calomel electrode.
3. Measure the cell potential using a voltmeter or potentiometer.
4. Calculate the standard electrode potential of a silver electrode.

Physics

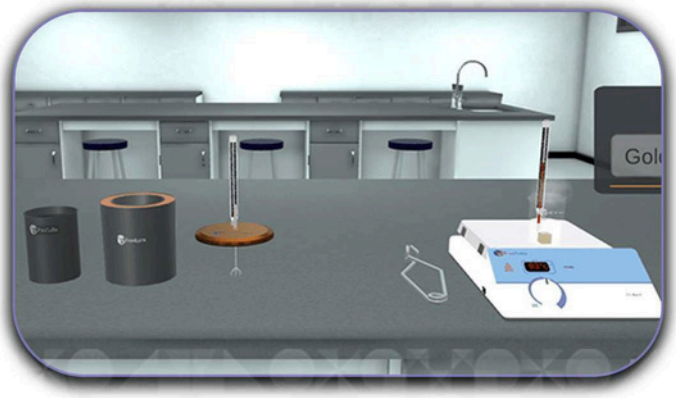
Properties of Matter | Magnetism | Waves

Modern Physics | Mechanics | Electricity

Heat and Thermodynamics

Heat and Thermodynamics

Specific Heat of Solids



Learning Objectives (ILOs)

- Define the specific heat capacity
- Set up an experiment to determine the specific heat capacities of three samples of different metals

Byole's Law of Gases



Learning Objectives (ILOs)

- Explain the relation between the pressure exerted on an ideal gas and the volume it occupies at constant temperature
- Set up an experiment to study the pressure-volume relation for an ideal gas

Joule's Experiment



Learning Objectives (ILOs)

- State the principle of conservation of energy
- Identify which types of energy were involved in the experiment
- Recognize how energy conversion takes place from electrical energy into heat energy
- Identify the different units used to measure energy
- Determine the value of the mechanical equivalent of heat and the coil resistance

Mechanics

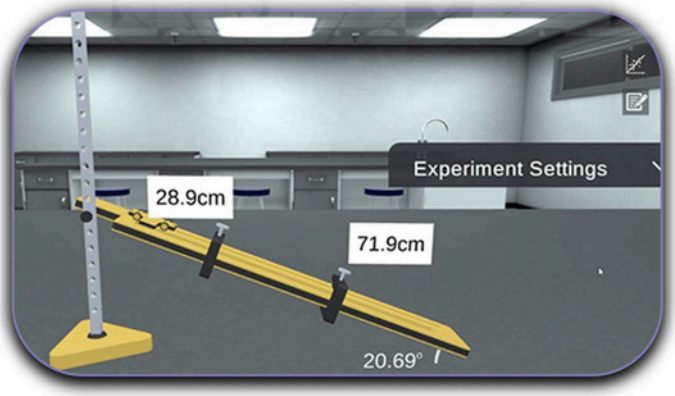
Free Fall



Learning Objectives (ILOs)

- Measure the displacement of a freely falling object.
- Test the hypothesis that the acceleration of a freely falling object is uniform.
- Calculate the uniform acceleration of a falling object due to gravity, g.
- Determine the instantaneous velocity of the falling object.

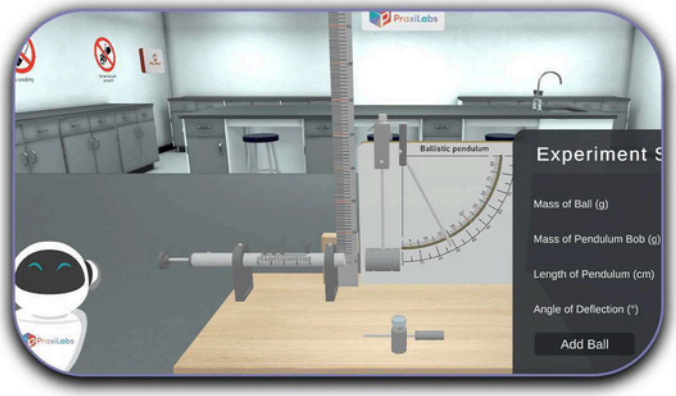
Motion on Inclined Surface



Learning Objectives (ILOs)

- Analyze the motion of a body on an inclined surface
- Determine the acceleration due to gravity

Ballistic Pendulum



Learning Objectives (ILOs)

- Understand the types of collisions
- Study the conservation of momentum and energy principals
- Calculate the initial velocity of the projectile ball in three ranges (short, medium, and long ranges)

Newton's Second Law



Learning Objectives (ILOs)

- To understand the meaning of net force and to use such an understanding to relate the values of individual forces to the value of the net force.
- To distinguish between the concepts of mass and weight and be able to perform calculations involving mass and weight.
- To state Newton's second law of motion, to express in equation form, and to use it to solve for acceleration, mass, or net force if knowledge of two of these three variables are known.
- To use free-body diagrams and the Newton's second law equation to determine the acceleration of an object.

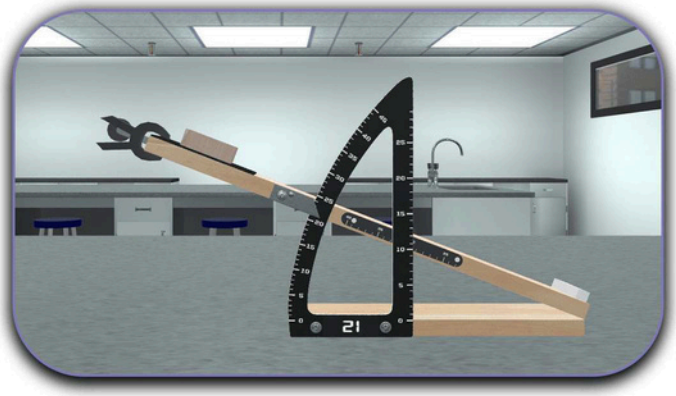
Lami's Rule



Learning Objectives (ILOs)

- Understand Lami's Rule.
- Apply Lami's Rule to find the unknown weight.
- Understand the relation between forces acting on a point at equilibrium and the angles between them.

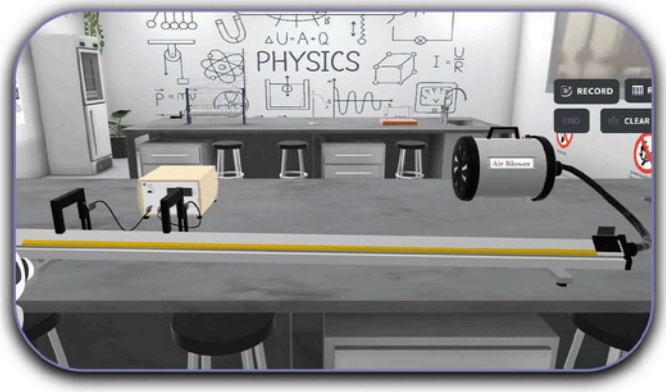
Static Friction Coefficient



Learning Objectives (ILOs)

- Calculate the static friction coefficient for different types of surfaces.

Linear Motion



Learning Objectives (ILOs)

- Analyze the motion of an object down a no friction inclined surface.
- Study the linear motion equations.
- Set up an experiment to determine the acceleration due to gravity and the angle of inclination of the air track.

Projectile Motion

NEW

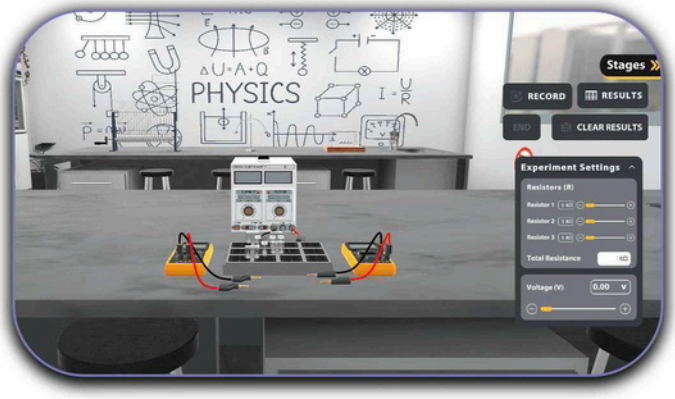


Learning Objectives (ILO):

1. Know the definition of projectile motion and its types.
2. Describe the horizontal and vertical components of the velocity of a projectile.
3. Numerically describe the various features associated with a projectile's trajectory (e.g., components of displacement, velocity and acceleration).
4. Use kinematic equations to analyze and solve horizontally-launched projectile problems.

Electricity

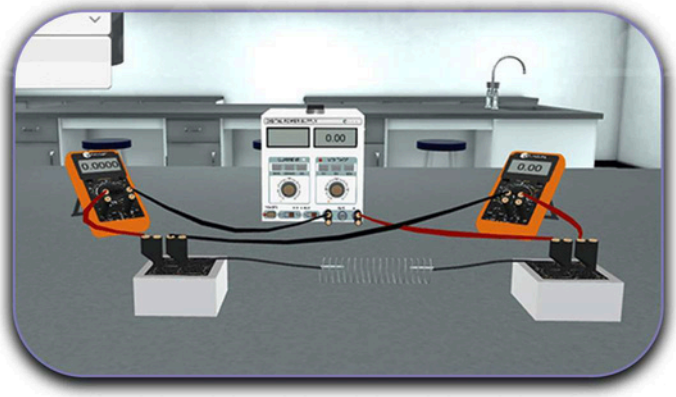
Measurement of Ohmic Resistances Using Ammeter and Voltmeter



Learning Objectives (ILOs)

- Understand the relation between current and voltage in a circuit with Ohmic resistance.
- Calculate the equivalent resistance when many resistors are connected in series or in parallel.
- Gain an understanding of how to connect the bridge to create a closed electrical circuit.

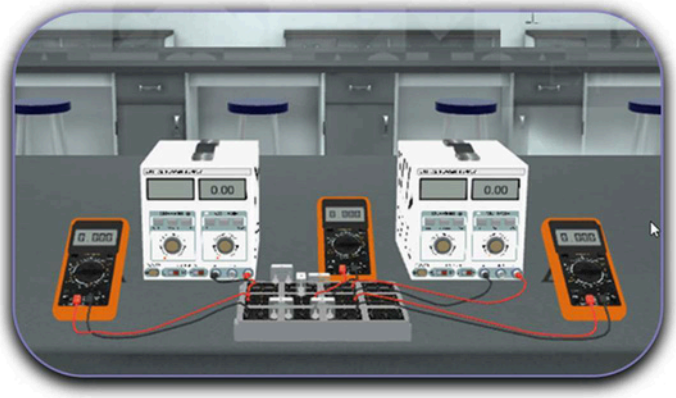
Study the I-V Characteristics of Non-Ohmic Resistance



Learning Objectives (ILOs)

- Understanding the difference between the non-Ohmic resistance and Ohmic resistance
- Set up an experiment to study the I-V characteristics of non-Ohmic resistors

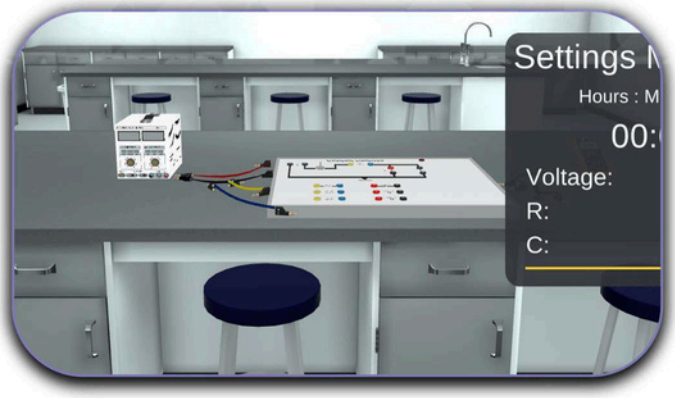
Kirchhoff's Loop Rule



Learning Objectives (ILOs)

- State Kirchhoff's laws for electric circuits
- Apply Kirchhoff's current law at node (or junction) points in an electric circuit
- Apply Kirchhoff's voltage law around closed loops within electric circuits
- Deduce the value of the current in different branches of an electric circuit

RC Circuit (Charging Capacitor)



Learning Objectives (ILOs)

- See the benefits of using the capacitor and understand what is the capacitance of the capacitor
- Understand that the variation of charging voltage with time depends on the capacitance and resistance
- Calculate capacitor's capacitance and the time constant

RC Circuit (Discharging Capacitor)



Learning Objectives (ILOs)

- See the benefits of using the capacitor and what is the capacitance of the capacitor
- Study the variation of discharge voltage with time and this depends on capacitance and resistance
- Calculate the capacitor's capacitance and time constant

Variation of the Resistance of a Thermistor with Temperature Experiment



Learning Objectives (ILOs)

- Differentiate between the NTC and PTC type thermistor.
- Learn how the resistance of the thermistor changes with temperature.
- Determine the value of activation energy (band gap energy) of thermistor material.

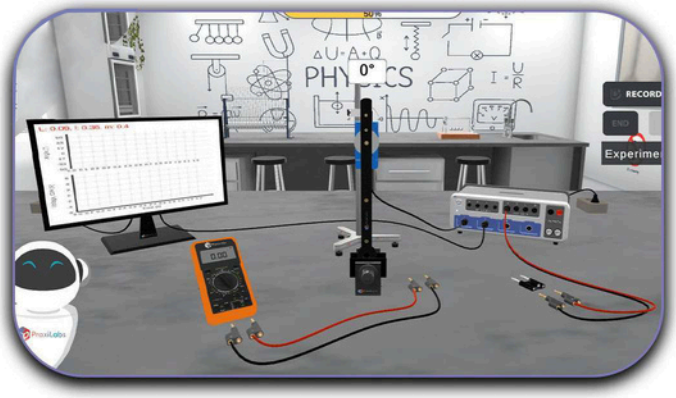
Electro Static Demonstration



Learning Objectives (ILOs)

- Charge an object by Rubbing.
- Charge an object by Contact.
- Charge an object by Induction.
- Measure the Charge at Different Locations on the Outer Surface of a Spherical Conductor.
- Measure the Charge on the Outer Surface of a Non-Spherical Conductor.
- Measure the Charge on the Inner Surface of a Spherical Conductor.

Faraday's Law



Learning Objectives (ILOs)

- Investigate the emf induced in a coil that is swinging through a magnetic field.
- Investigate the energy conversion from mechanical energy to electrical energy.
- Verify the Faraday's Law.
- Demonstrate the lightly damped oscillation of the hall probe as a simple pendulum.
- Find the amount of energy lost due to lightly damped oscillation.

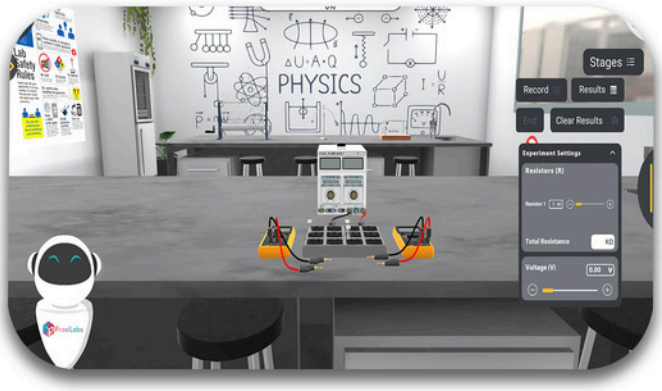
Parallel plate capacitor



Learning Objectives (ILOs)

- Explain parallel plate capacitors and their capacitances.
- Discover how the capacitance of conducting parallel plates is related to the separation distance between the plates and the surface area of the plates.
- Determine the dielectric constant for different material.
- Discover how the charge on the conducting plates is related to the input voltage to the plates.
- Discover how the charge on the conducting plates is related to the input voltage to the plates using a dielectric material.

Ohm's Law



Learning Objectives (ILOs)

- Understand the relation between current and voltage in a circuit with Ohmic resistance.
- Calculate the equivalent resistance when many resistors are connected in series or in parallel.
- Gain an understanding of how to connect the bridge to create a closed electrical circuit.

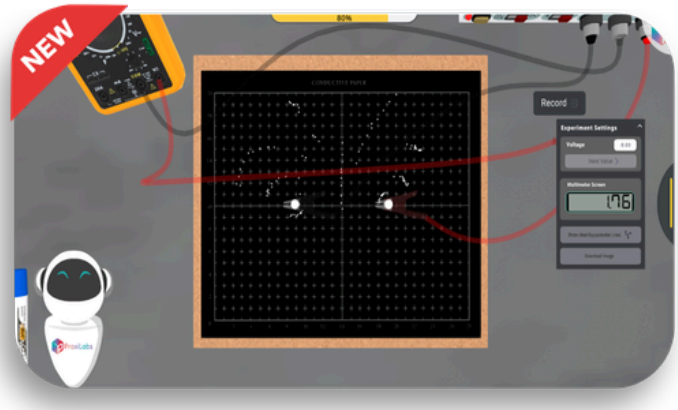
Parallel plates capacitor NEW



Learning Objectives (ILO):

1. Understand what a parallel plate capacitor is.
2. Experimentally observe how the capacitance of a capacitor changes as the distance between the two plates changes.
3. Observe how the capacitance changes by placing a dielectric material between the plates.
4. Observe the effect of changing the charging voltage on the charge quantity on the plates.
5. Observe the effect of changing the charging voltage on the charge quantity while different dielectric materials are placed between the plates.

Equipotential and Field Mapper NEW



Learning Objectives (ILO):

1. Understand the relationship between equipotential and electric fields.
2. Become familiar with the effect of conductors on equipotential and electric fields.
3. Experimentally determine the characteristics of the electric field surrounding oppositely-charged electrodes in different configurations.
4. Use the principles of electric fields and electric potential energy to experimentally determine the lines of equal electric potential (equipotential) surrounding oppositely-charged electrodes.

Magnetism

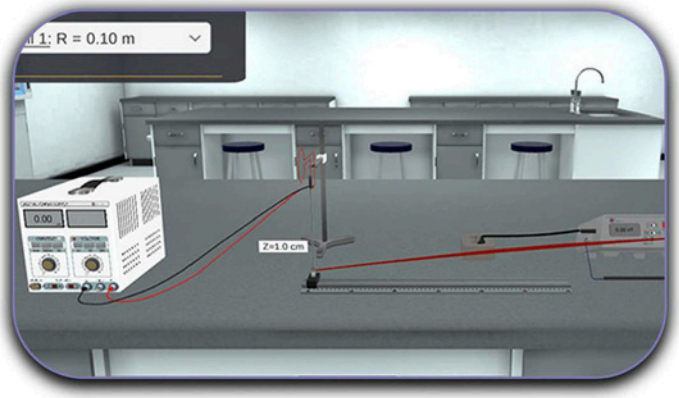
Magnetic Moment of a Bar Magnet



Learning Objectives (ILOs)

- Explain the operation of the tangent galvanometer
- Set up an experiment to study the magnetic properties of a bar magnet
- Determine the value of the pole strength of a bar magnet

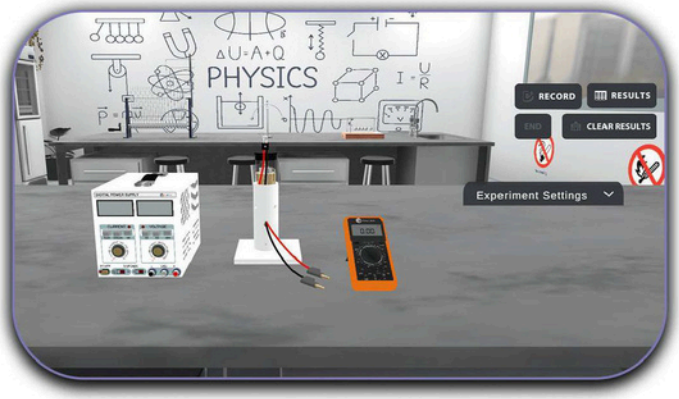
Magnetic Field of a Circular Loop Current



Learning Objectives (ILOs)

- Enumerate the factors affecting the magnetic field due to circular loop carrying current
- Set up an experiment to study the magnetic field produced by current passing through a circular loop along its axis

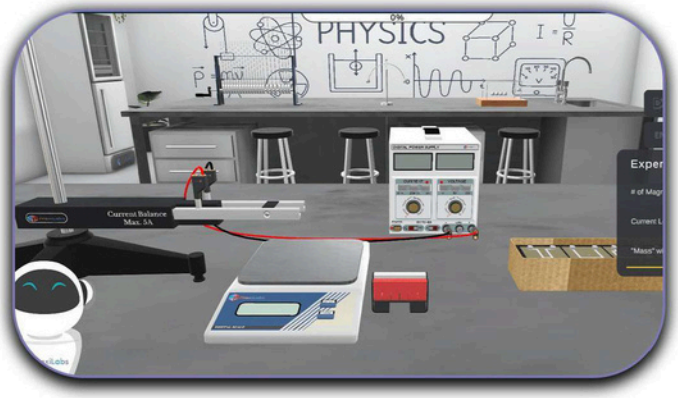
Temperature Coefficient of Resistance



Learning Objectives (ILOs)

- Understand the theory of conduction.
- Analyze this dependence between resistance and temperature.
- Determine the temperature coefficient of resistance of any material.

Magnetic Force on a wire



Learning Objectives (ILOs)

- Recognize that if a current-carrying wire is placed in a magnetic field, there will be a force on it and it may move.

- Recognize that the wire must be placed perpendicular to the magnetic field for the magnitude of the force to be greatest.

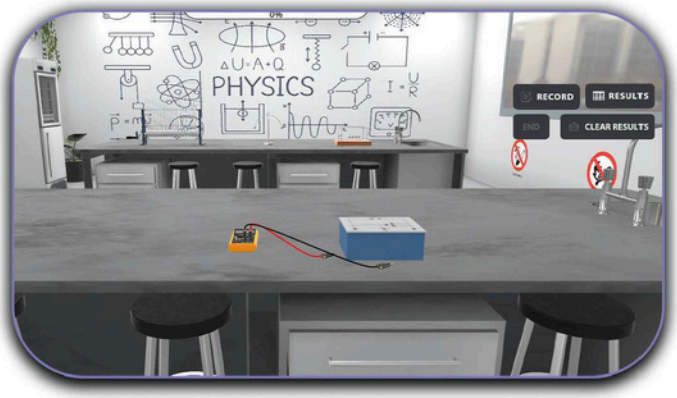
- Recognize that if the wire is placed parallel to the field, there will be no force on it.

- Work out the direction of the force using right-hand rule.

- Use the magnetic force apparatus to verify that the magnetic force due to a current-carrying wire immersed in a uniform magnetic field is proportional to each of the following parameters:

  - Length of the wire
  - Electrical current flowing in the wire
  - Magnitude of the magnetic field
  - The angle between the magnetic field and the direction of the current in the wire.

Determination of unknown capacitance and inductance using phasor diagrams and AC circuits



Learning Objectives (ILOs)

- Calculate the capacitive reactance.

- Calculate the inductive reactance.

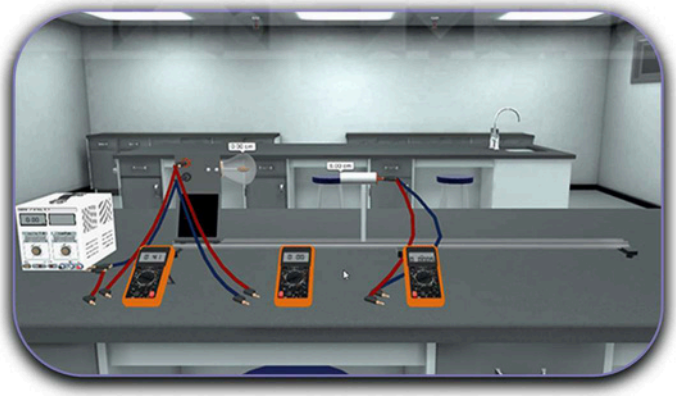
- Measure phase angles between voltages.

- Draw a voltage phasor diagram for resistors and capacitors in series.

- Draw a voltage phasor diagram for resistors and inductors in series.

Modern Physics

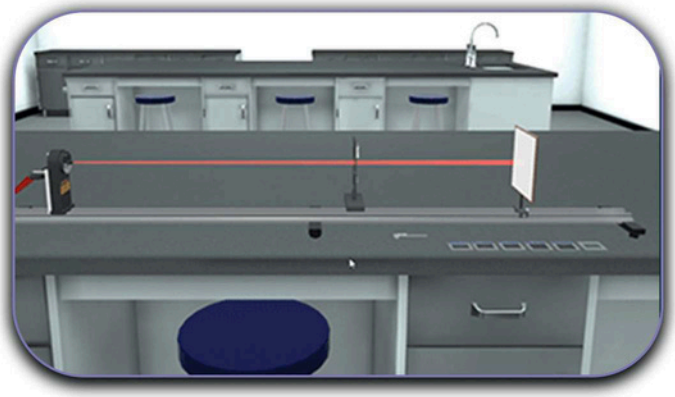
Black Body Radiation



Learning Objectives (ILOs)

- Verify the fourth law of radiation
- Generate Planck's curves for Stefan Boltzmann lamp at different temperatures and verify Wien's law
- Verify the inverse square law for electromagnetic (EM) radiation

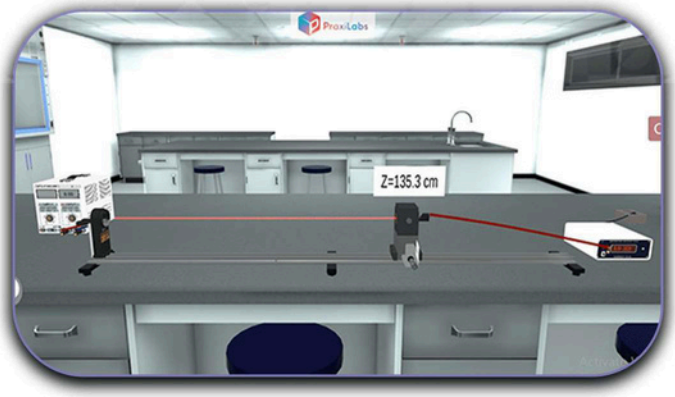
Optics Lab



Learning Objectives (ILOs)

- Set up an experiment to study the interference and diffraction phenomena for monochromatic light
- Explain the resulting interference and diffraction spectra
- Use the experiment to determine the width of a human hair

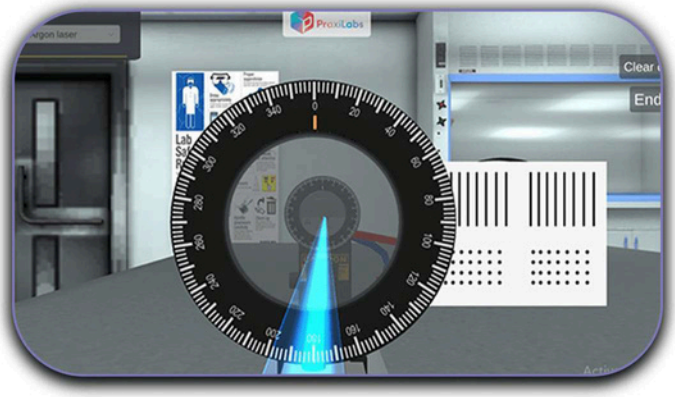
Laser Beam Divergence



Learning Objectives (ILOs)

- Define the profile of a laser beam
- Set up an experiment to study the laser beam profile
- Determine the laser beams' diameter
- Prove that the laser does not obey the inverse square law

Laser Electro-Optic Effect



Learning Objectives (ILOs)

- Explain the electro-optic effect in a Lithium Niobate crystal
- Set up an experiment to study the electro-optic effect in crystals
- Determine the half-voltage value of electro-optic crystals

Millikan Oil Drop



Learning Objectives (ILOs)

- Explain the effect of the electric field on the motion of charged particles within it
- Analyze the motion of charged oil drop within an electric field in terms of the different factors affecting its motion
- Demonstrate that electric charge only comes in discrete units – "the quantization of charge"
- Measure the intrinsic charge of the electron (the smallest discrete unit of charge)

Michelson Interferometer



Learning Objectives (ILOs)

- Construct the Michelson interferometer
- Recognize the function of each component in the interferometer
- Understand the operation of the interferometer
- Interpret the observed in the interference pattern

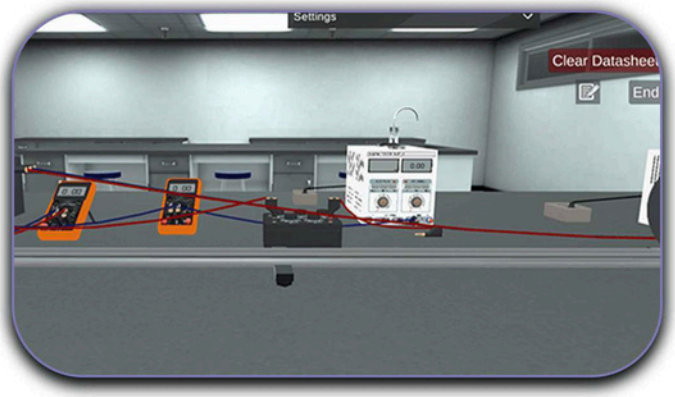
I-V Characteristics of Solar Cell (I)



Learning Objectives (ILOs)

- Describe the construction and operation of the PV cell
- Enumerate the different factors that may affect the operation of the PV cell
- Analyze the equivalent circuit of the PV cell and its parameters

I-V Characteristics of Solar Cell (II)



Learning Objectives (ILOs)

- Describe the construction and operation of the PV cell
- Enumerate the different factors that may affect the operation of the PV cell

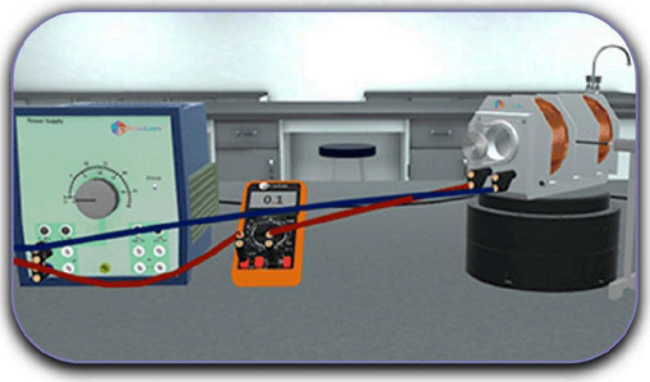
I-V Characteristics of Solar Cell (III)



Learning Objectives (ILOs)

- Describe the construction and operation of the PV cell
- Enumerate the different factors that may affect the operation of the PV cell

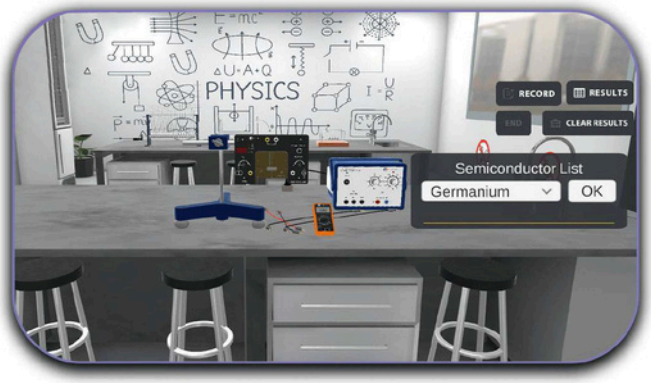
Zeeman Effect Experiment



Learning Objectives (ILOs)

- Observe the Zeeman triplet and doublet splitting of the characteristic red line (643.8 nm) in transverse and longitudinal configurations, respectively
- Understand the operation of the Fabry-Perot interferometer (etalon)
- Set up an experiment to study the normal Zeeman effect in Cadmium (as an example of singlet systems (Total Spin Momentum = 0)
- Determine the polarization state of the triplet and doublet components

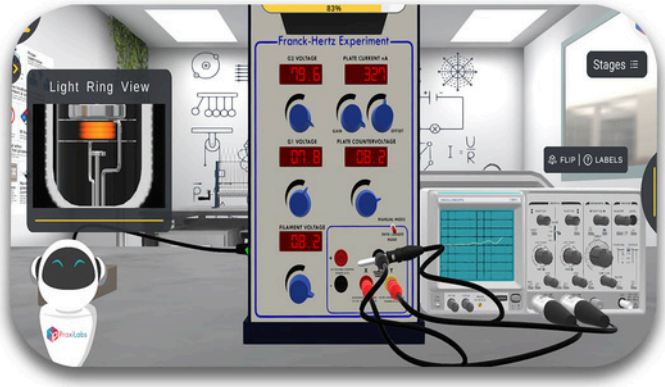
Band gap energy of semiconductors



Learning Objectives (ILOs)

- Study the relation between the resistivity of the semiconductor and the temperature.
- Find the energy gap for the semiconductor.

Franck-Hertz Experiment Using Neon Tube

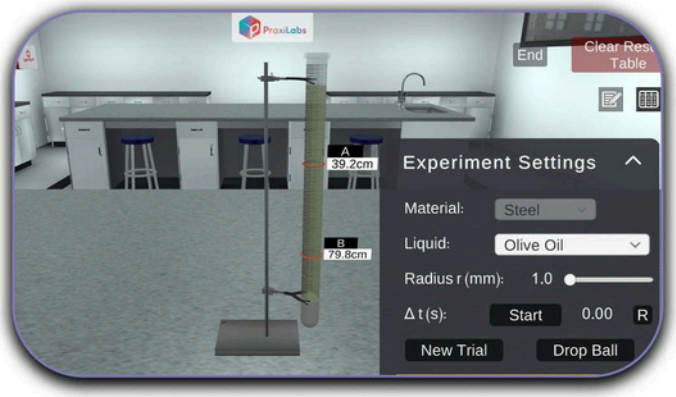


Learning Objectives (ILOs)

- To record a Franck-Hertz curve for neon.
- To measure the discontinuous energy emission of free electrons for inelastic collision.
- To interpret the measurement results as representing discrete energy absorption by neon atoms.
- To observe the Ne-spectral lines resulting from the electron-collision excitation of neon atoms.
- To identify the luminance phenomenon as layers with a high probability of excitation.

Properties of Matter

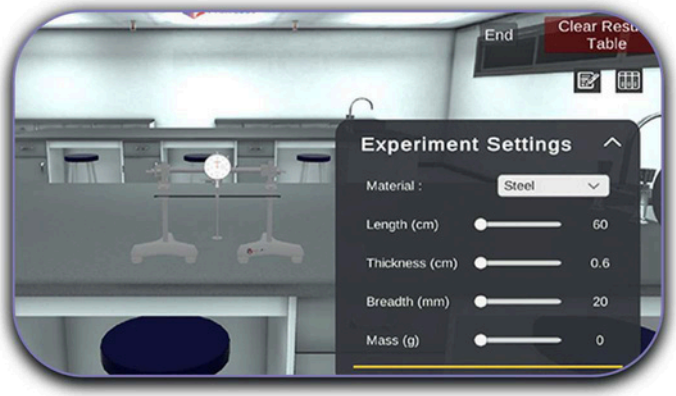
Determination of the Coefficient of Viscosity by Using Stokes Method



Learning Objectives (ILOs)

- Employ Stokes Method to find the terminal velocity of an object in a viscous medium
- Enumerates the different factors that could alter the viscosity of a liquid

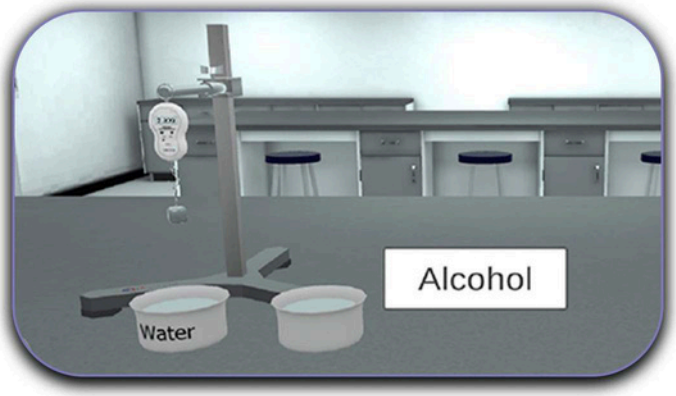
Young's Modulus for a Metallic Rod



Learning Objectives (ILOs)

- Understand the relation between stress and strain
- Predict the behavior of material undergoing elastic deformation
- Determine the value of Young's modulus of elasticity

Archimedes Principle



Learning Objectives (ILOs)

- Understanding the concept of Archimedes principle and the physics behind buoyancy force
- Set up an experiment to determine the specific gravity of a solid or a liquid. Hence, the material can be identified

Density Measurement



Learning Objectives (ILOs)

- Define the density of a material
- Understand that the density is a property of the material
- Identify the type of material from the density measurement
- Prepare a suitable experimental setup to determine the density of a material in the form of a regular solid, irregular solid, and liquids

Waves

Focal Length of a Convex Lens Using General Law



Learning Objectives (ILOs)

- Understand the image formation for a convex lens
- Understanding the difference between both the focal length and power of a lens and how to determine them

Simple Pendulum



Learning Objectives (ILOs)

- Understand the motion of a simple pendulum under small angle approximation
- Introduce the simple harmonic motion as an example for periodic motion
- Understand the source of experimental error for a real pendulum

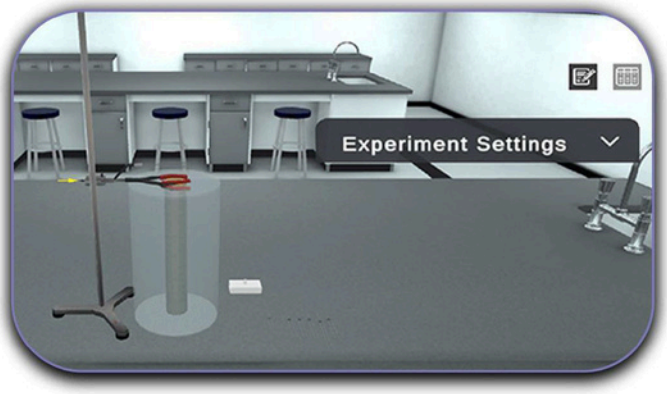
Hooke's Law



Learning Objectives (ILOs)

- State Hooke's law
- Enumerate the factors affecting the spring constant
- Set up an experiment to determine the spring constant using static and dynamic methods

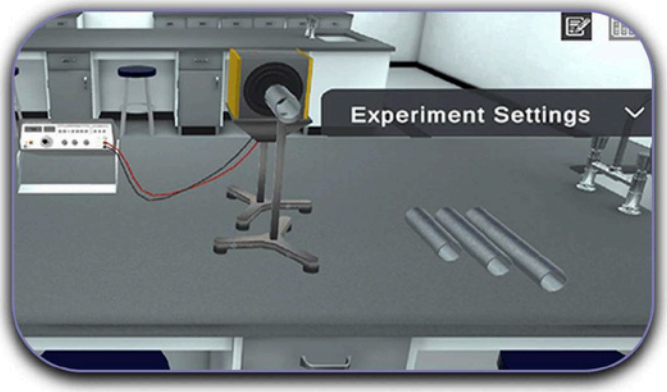
Speed of Sound Using Closed Columns



Learning Objectives (ILOs)

- Differentiate between types of waves
- Explain how standing waves can be generated in closed air columns
- Explain the occurrence of resonance phenomena in closed-air columns

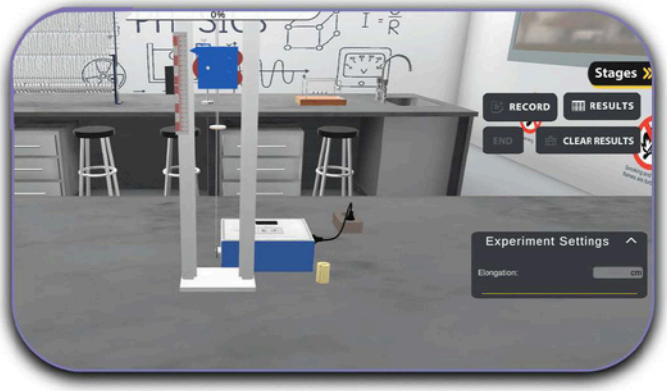
Speed of Sound Using Open Columns



Learning Objectives (ILOs)

- Explain the resonance phenomena in an open air column
- Set up an experiment to determine the speed of sound in air using an open air column

Forced Oscillations



Learning Objectives (ILOs)

- Measure the spring constant (force constant) of a spring.
- Investigate the frequency response of a spring-mass system.

Safety Laboratory



Learning Objectives (ILOs)

- Identify different safety signs
- Distinguish between different types of signs
- Practice a real experiment applying safety measures
- Anticipate right and wrong actions in a science lab
- Examine material safety data sheet
- Decide what to do if small accidents could happen