Activity 1: Crafting and Designing Switches

Subject: Physical Science	Topic or Unit of Study: Circuits
Grade/Level: Grades 4-8	Time Allotment: 1 hour
 Objectives: We will use everyday materials to solve a problem. We will design and test a device that can complete a circuit. We will investigate electrical engineering concepts. 	 Standards: 4-PS3-2: Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents. 3-5-ETS1-1: Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost. 3-5-ETS1-2: Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
Synopsis: Design momentary and non-momentary sensors to work with future projects.	 Materials: Teacher/instructor lesson plan Teacher/instructor Google Slides presentation Teacher computer with access to internet and teacher presentation Student computers Makey Makey Classic kits (one per student) Graphite pencils Binder clips Blank white paper Cardboard pieces (approximately 3"x3" pieces; one per student) Brass fasteners (two per student) Large paper clips (one per student)

Activity 2: Designing and Crafting Alarm Systems

Subject: Physical Science	Topic or Unit of Study: Circuits
Grade/Level: Grades 4-8	Time Allotment: 2 hours
 Objectives: We will design creative solutions for unique problems. We will understand the importance of cause-and-effect while designing alarms. 	 Standards: 4-PS3-2: Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents. 6-AP.A.01: Use an existing algorithm or pseudocode to solve a problem. 7.AP.A.01: Select and modify existing algorithms and pseudocode to solve complex problems.
Synopsis: We will design an alarm system to work with momentary and non-momentary switches.	 Materials: Teacher/instructor lesson plan Teacher/instructor Google Slides presentation Teacher computer with access to internet and teacher presentation Student computers with access to Scratch Makey Makey Classic kits (one per student) Paper clip push button switch from previous intermediate Makey Makey session Binder clip switch from previous intermediate Makey Makey session

Activity 3: Recyclable Tilt Sensors

Subject: Physical Science	Topic or Unit of Study: Circuits/Sensors
Grade/Level: 4-8	Time Allotment: 2.5-3 hours
 Objectives: Students will learn about sensors. Students will learn how to use Makey Makey. Students will build a tilt sensor. Students will play/create games using the tilt sensor. 	 Standards: 4.CS.HS.01: Identify and describe a variety of ways computer hardware and software work together as a system to accomplish a task, using appropriate technical terminology (e.g., input, output, processors, sensors, storage). 6.AP.A.01: Use an existing algorithm or pseudocode to solve a problem. MS-ETS1-4: Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.
Synopsis: Students will learn about sensors. They will build a tilt sensor and play a game on scratch. They will evaluate how their game play went and then modify their sensor to improve their game.	 Materials: Teacher/instructor lesson plan Teacher/instructor Google Slides presentation Teacher computer with access to internet and teacher presentation Student computers Makey Makey Classic kits (one per student) Toilet paper rolls (one per student) Large paper clips (two per student) Tin foil One piece per student to line inside of roll Two strips to cover ends of roll Marbles (one per student) Glue Scissors

Activity 7: Prototype Game Controller for Makey Makey Soccer App

Subject: Physical Science	Topic or Unit of Study: Circuits
Grade/Level: Grades 4-8	Time Allotment: 2 hours
 Objectives: We will create a PlayDoh D-Pad. We will create a joystick game controller. We will design our own inventions. 	 Standards: 3.CS.HS.01: Identify and describe a variety of ways computer hardware and software work together as a system to accomplish a task, using appropriate technical terminology (e.g., input, output). 4.AP.A.01: Develop, compare, and refine multiple algorithms for the same task. 6.AP.A.01: Use an existing algorithm or pseudocode to solve a problem.
Synopsis: We will make a few different types of joystick game controllers and then be challenged to design our own invention!	 Materials: Teacher/instructor lesson plan Teacher/instructor Google Slides presentation Teacher computer with access to internet and teacher presentation Student computers Makey Makey Classic kits (one per student) Play Doh (four colors per student) Paper clips (nine per student) Cardboard (one 3" x 3" square per student) Foil (one 4" x 4" square per student) Cardstock (one 3" x 3" square per student) Scotch tape (approx. 6 inches/student) Binder clips (one per student)

Activity 8: Makey Makey Dance Revolution

Subject: Physical Science	Topic or Unit of Study: Circuits
Grade/Level: Grades 4-8	Time Allotment: 2 hours
 Objectives: We will create closed circuits. We will use Dance Dance Revolution remix on Scratch. 	 Standards: 4.CS.HS.01: Identify and describe a variety of ways computer hardware and software work together as a system to accomplish a task, using appropriate technical terminology (e.g., input, output, processors, sensors, storage). 6.AP.A.01: Use an existing algorithm or pseudocode to solve a problem. MS-ETS1-4: Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved. MS-ETS1-2: Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
Synopsis: We will use foil and posterboard to create our own dance floor!	 Materials: Teacher/instructor lesson plan Teacher/instructor Google Slides presentation Teacher computer with access to internet and teacher presentation Student computers Makey Makey Classic kits (one per student) Aluminum duct tape (approx 4 feet per student) Poster board or other thick paper (12" x 20" or larger per student) Conductive wire (16 feet per student) Scissors Electrical tape Decorating supplies (paint, makers, pens, pencils)

Activity 6: Pixel Art Finger Paint

Subject: Physical Science	Topic or Unit of Study: Circuits
Grade/Level: Grades 4-8	Time Allotment: 2 hours
 Objectives: We will understand how to plot points on a coordinate plane both physically and virtually. We will combine this technique to make physical computing pixel paint. 	Synopsis: We will combine conductive touch points on a coordinate plane and code pixel art Finger paint in Scratch!
 Standards: 3.CS.D.01: Identify and troubleshoot, using appropriate technical terminology, simple hardware and software problems that may occur during everyday use. 5.AP.M.02: Modify, remix, or incorporate portions of an existing program into one's own work, to develop or add more advanced features. 6.AP.A.01: Use an existing algorithm or pseudocode to solve a problem. 8.AP.C.01: Develop secure programs that utilize combinations of nested loops, compound conditionals, procedures with and without parameters, and the manipulation of variables representing different data types. 	 Materials: Teacher/instructor lesson plan Teacher/instructor Google Slides presentation Teacher computer with access to internet and teacher presentation Student computers Makey Makey Classic kits (one per student) Dull pencils (one per student) Pens (one per student) Binder clips (four per student) Brass fasteners (ten per student) (have extras on hand) Plot Points and Key Press chart copies (one per student) 12" square pieces of cardboard with a pre-drawn coordinate plane Electrical tape (approximately 6" per student) X and Y axis labeled from -200 to 200 in 20-unit increments)

Activity 5: Advanced Sequencing, Music, and Secret Codes

Subject: Physical Science	Topic or Unit of Study: Circuits
Grade/Level: Grades 4-8	Time Allotment: 2 hours
 Objectives: We will create a variable. We will create our own sequence. We will implement conductive touch pads to create a musical instrument. 	 Standards: 3.CS.D.01: Identify and troubleshoot, using appropriate technical terminology, simple hardware and software problems that may occur during everyday use. 5.AP.C.01: Create programs using a programming language that includes sequences, loops, conditionals, event handlers, and variables that utilize mathematics operations to manipulate values in order to solve a problem or express idea. 5.AP.M.02: Modify, remix, or incorporate portions of an existing program into one's own work, to develop or add more advanced features. 8.AP.C.01: Develop secure programs that utilize combinations of nested loops, compound conditionals, procedures with and without parameters, and the manipulation of variables representing different data types.
Synopsis: Craft a cardboard synthesizer and code secret sequences for custom animations.	 Materials: Teacher/instructor lesson plan Teacher/instructor Google Slides presentation Teacher computer with access to internet and teacher presentation Student computers Makey Makey Classic kits (one per student) Metal paper clips (five per student) Brass fasteners (five per student) Pre-scored Cardboard (~8" x 11" piece; one per student; see video for how to pre-score) Flat cardboard (~8" x 11" piece; one per student) Aluminum foil Binder clips (two per student) Tacky glue Scissors (one pair per student)

Activity 4: Using Secret Codes to Create a Makey Makey Life Cycle Project

Subject: Physical Science	Topic or Unit of Study: Circuits
Grade/Level: Grades 4-8	Time Allotment: 2 hours
 Objectives: We will understand the life cycle. We will code a life cycle project. We will use coding concepts to design animations. 	 Standards: 4.CS.HS.01: Identify and describe a variety of ways computer hardware and software work together as a system to accomplish a task, using appropriate technical terminology (e.g., input, output, processors, sensors, storage). 6.AP.A.01: Use an existing algorithm or pseudocode to solve a problem. MS-ETS1-4: Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved. MS-ETS1-2: Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
Synopsis: In this session, you'll learn how to code sequence and secret code projects, and how to connect them to drawings or other physical elements in the real world that trigger animations in the digital world!	 Materials: Teacher/instructor lesson plan Teacher/instructor Google Slides presentation Teacher computer with access to internet and teacher presentation Student computers Makey Makey Classic kits (one per student) 6B graphite pencils (one per student) Poster paper (one per student) Office supplies: brass fasteners, paper clips, binder clips, etc.