

Labdisc activities with links - correlated with NGSS

Science field	Science topic	Labdisc Experiment				NGSS	
		Experiment name	Sensors	Labdisc Type	Experiment description	K-2	3-5
PHYSICS	Heat	Absorbance of heat	Ext. Temp.	Biochem, Gensci, Physio	Measuring and comparing the internal temperature of different colored containers full of water after being exposed to sunlight.		4-PS3-2. Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.
	Electricity	Lentz law	Current	Physio	The connection between electric and magnetic fields.		
	Electricity	Resistor Networks	Current, Voltage	Physio	Measuring the current and voltage of two simple electric circuits (in series and parallel) and determining the differences between them		4-PS3-2. Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.
	Magnetic Field	Earth magnetic field	Magnetic field external sensor	Any Labdisc	Using the Magnetic Field sensor to check the magnetic field of the Earth poles	3-PS2-3. Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.	
	Magnetic Field	Magnetic field of a coil	Magnetic field external sensor	Any Labdisc	Biot-Savat's Law - Using the Magnetic Filed sensor to check the magnetic field inside and around an electronic coil		
	Optics	Light intensity	Light	Biochem, Gensci, Physio	Measuring and comparing the luminosity of a candle, a flashlight and natural day-light.		5-PS1-3. Make observations and measurements to identify materials based on their properties.
	Optics	Light absorbance	Light	Biochem, Gensci, Physio	Comparing the absorbance of light with different sun glasses	1-PS4-3. Plan and conduct an investigation to determine the effect of placing objects made with different materials in the path of a beam of light.	4-PS4-2. Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.
	Optics	Light vs.. distance	Light, Distance	Physio, Gensci	Recording light intensity while moving away from the light source.		4-PS3-2. Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.
	Sound Waves	Sound level vs. distance	Sound	Gensci, Physio	"Sound Level Versus Distance" Measuring the sound level decay over distance	1-PS4-1. Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate.	4-PS3-2. Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.

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PHYSICS	Sound Waves	Sound wave	Sound	Gensci, Physio	"Sound Waves" Recording sound waves and sound wave interference	1-PS4-1. Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate.	4-PS4-1. Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.
	Mechanics	Free fall	Distance	Physio, Gensci	Measuring the free fall acceleration using a ping-pong ball..		3-PS2-1. Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object. 5-PS2-1. Support an argument that the gravitational force exerted by Earth on objects is directed down.
	Mechanics	Traveling speed	GPS	Biochem, Gensci	Using the GPS sensor to measure walking speed, running speed and/or biking speed – a great activity for creating a contest between students.	K-PS2-2. Analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or a pull.	4-PS3-1. Use evidence to construct an explanation relating the speed of an object to the energy of that object.
	Mechanics	Impact and momentum	Distance	Gensci, Physio	Using the distance sensor to measure the speed of two carts before and after a plastic collision.	K-PS2-2. Analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or a pull.	4-PS3-3. Ask questions and predict outcomes about the changes in energy that occur when objects collide.
	Mechanics	The laws of motion	Accelerator	Dymo sensor	Determining the relationship between speed time and distance as part of understanding Newton's mechanic principles.		
	Mechanics	Hooks law	Force	Dymo sensor	Using a metal spring to investigate the spring coefficient K and the equation $F = -kx$.		
	Mechanics	Friction	Force	Dymo sensor	Investigating the static and dynamic friction of a body moving on different surfaces.		
	Mechanics	Harmonic motion	Force	Dymo sensor	Investigating the motion of a mass on a spring.		

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		Experiment name	Sensors	Labdisc Type	Experiment description	K-2	3-5
CHEMISTRY	Acid and Base	What do we drink?	pH electrode	Biochem, Gensci	Measuring the pH of different soft drinks.		
	Chemical reactions	Endothermic / Exothermic	Ext. Temp.	Biochem, Gensci, Physio	Performing different measurements to examine which reactions release or consume heat.		
	Gas law	Boyle's law	Air pressure	Biochem, Gensci, Physio	Measuring the connection between volume and pressure: $PV=NRT$, by using a syringe to show the linear relation between volume and air pressure.		
	Heat Energy	Candle flame	Thermocouple	Biochem	Exploring the temperature zones of a candle flame.		4-PS3-2. Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.
	Phase Change	Phase change	Ext. Temp.	Biochem, Gensci, Physio	A classic activity measuring the freezing and boiling point of water.	2-PS1-4. Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot.	5-PS1-2. Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved.
	pH titration	pH titration	pH electrode, Ext. Temp.	Biochem, Gensci	Classic Acid and Base titration - measuring pH and temperature change (Also using an external temperature sensor).		
	Specific heat	Specific heat	Ext. Temp.	Biochem, Gensci, Physio	Heating different liquids to the same temperature (70°C) and comparing the cooling curves of these liquids to explain which has the higher specific heat.		4-PS3-2. Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.
	Spectrophotometry	Lamber Beer law	Turbidity	Biochem	Determining the relationship between a solution concentration and its light absorbance		

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Science field	Science topic	Labdisc Experiment				NGSS	
		Experiment name	Sensors	Labdisc Type	Experiment description	K-2	3-5
BIOLOGY	Human body	Our heart rate	Heart rate	Biochem	Measuring the heart rate before and after exercise and recording useful information to determine physiological parameters.		
	Human body	Mammalian diving reflex	Heart rate	Biochem	Decreasing the heart rate when seeming in cold water to preserve body heat		
	Human body	Sweat production	Humidity, Amb. & Ext. Temp.	Biochem, Gensci	Covering our hand with a plastic bag, while measuring temperature and relative humidity to explain the principle of the body's cooling system – sweat.		
	Human body	CO2 during respiration	External CO ₂ probe	Any Labdisc	Investigating bean seeds respiration, using the CO ₂ sensor.		
	Plants	Photosynthesis is	Air pressure, Light	Biochem, Gensci	Recording air pressure and light level, while using an Elodea water plant sealed in a test-tube - to measure the effect of photosynthesis and the relation between light intensity and oxygen production by the plant.	K-LS1-1. Use observations to describe patterns of what plants and animals need to survive.	5-LS1-1. Support an argument that plants get the materials they need for growth chiefly from air and water.
	Plants	Photosynthesis is	DO ₂ electrode	Biochem	Using a DO ₂ sensor to check the Photosynthesis rate of an Elodea plat in different light intensities.		

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EARTH and SPACE SCIENCE	Atmosphere	Greenhouse effect	Amb. & Ext. Temp.	Biochem, Gensci, Physio	Building a small greenhouse and measuring the temperature inside and outside the greenhouse placed in a lighted area	K-PS3-2. Use tools and materials to design and build a structure that will reduce the warming effect of sunlight on an area.	
	Atmosphere	Altitude and Air pressure	Barometer and GPS	Biochem	Using the Barometer and GPS sensors to travel from high to low places, measuring the change in air pressure and altitude.	K-ESS2-1. Use and share observations of local weather conditions to describe patterns over time.	
	Atmosphere	Walk in the park	Sound, ext. Temp., humidity	Gensci	Measuring the changes in noise, temperature and humidity in different urban areas.	K-ESS2-1. Use and share observations of local weather conditions to describe patterns over time.	
	Atmosphere	Green lungs	External CO ₂ probe		Study the effect plants and parks have on reducing the CO ₂ gas level in urban areas.		
	Atmosphere	Week temperature	Amb./ Ext. Temp.	Biochem, Gensci, Physio	Recording of temperature changes over a week. Using the results to predict weather in the coming days	K-ESS2-1. Use and share observations of local weather conditions to describe patterns over time.	3-ESS2-1. Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.
	Hydrosphere	Acid rain	pH electrode	Biochem, Gensci	Collecting rain in different area and verifying the acidity of the rain as it relates to pollution.		
	Hydrosphere	Water quality	Turbidity	Biochem	Comparing drinking water turbidity to other water taken from lakes and ponds.		
	Hydrosphere	Water Bodies	Amb. & Ext. Temp., Humidity	Biochem, Gensci	Measuring temperature and humidity near rivers or other water bodies to determine their effect on the environment.	2-ESS2-2. Develop a model to represent the shapes and kinds of land and bodies of water in an area.	5-ESS2-2. Describe and graph the amounts of salt water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth.
	Space Science	Day and Night	Amb./ Ext. Temp., Light	Biochem, Physio, Gensci	Recording the variations of temperature and light during a period of 24 hours to establish relations between them.	1-ESS1-2. Make observations at different times of year to relate the amount of daylight to the time of year	5-ESS1-2. Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.

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Science field	Science topic	Labdisc Experiment				NGSS	
		Experiment name	Sensors	Labdisc Type	Experiment description	MS	HS
PHYSICS	Heat	Absorbance of heat	Ext. Temp.	Biochem, Gensci, Physio	Measuring and comparing the internal temperature of different colored containers full of water after being exposed to sunlight.	MS-PS3-4. Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.	
	Electricity	Lentz law	Current	Physio	The connection between electric and magnetic fields.	MS-PS2-5. Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.	HS-PS2-5. Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current.
	Electricity	Resistor Networks	Current, Voltage	Physio	Measuring the current and voltage of two simple electric circuits (in series and parallel) and determining the differences between them		
	Magnetic Field	Earth magnetic field	Magnetic field external sensor	Any Labdisc	Using the Magnetic Field sensor to check the magnetic field of the Earth poles		
	Magnetic Field	Magnetic field of a coil	Magnetic field external sensor	Any Labdisc	Biot-Savat's Law - Using the Magnetic Filed sensor to check the magnetic field inside and around an electronic coil	MS-PS2-3. Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.	HS-PS2-5. Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current.
	Optics	Light intensity	Light	Biochem, Gensci, Physio	Measuring and comparing the luminosity of a candle, a flashlight and natural day-light.		
	Optics	Light absorbance	Light	Biochem, Gensci, Physio	Comparing the absorbance of light with different sun glasses	MS-PS4-2. Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.	
	Optics	Light vs.. distance	Light, Distance	Physio, Gensci	Recording light intensity while moving away from the light source.		
	Sound Waves	Sound level vs. distance	Sound	Gensci, Physio	"Sound Level Versus Distance" Measuring the sound level decay over distance		HS-PS4-1. Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.

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PHYSICS	Sound Waves	Sound wave	Sound	Gensci, Physio	"Sound Waves" Recording sound waves and sound wave interference	MS-PS4-1. Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.	HS-PS4-1. Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.
	Mechanics	Free fall	Distance	Physio, Gensci	Measuring the free fall acceleration using a ping-pong ball..		HS-PS2-4. Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects.
	Mechanics	Traveling speed	GPS	Biochem, Gensci	Using the GPS sensor to measure walking speed, running speed and/or biking speed – a great activity for creating a contest between students.	MS-PS3-1. Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.	
	Mechanics	Impact and momentum	Distance	Gensci, Physio	Using the distance sensor to measure the speed of two carts before and after a plastic collision.	MS-PS2-1. Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.	HS-PS2-3. Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.
	Mechanics	The laws of motion	Accelerator	Dymo sensor	Determining the relationship between speed time and distance as part of understanding Newton's mechanic principles.	MS-PS3-2. Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.	HS-PS2-1. Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.
	Mechanics	Hooks law	Force	Dymo sensor	Using a metal spring to investigate the spring coefficient K and the equation $F = -kx$.		
	Mechanics	Friction	Force	Dymo sensor	Investigating the static and dynamic friction of a body moving on different surfaces.		
	Mechanics	Harmonic motion	Force	Dymo sensor	Investigating the motion of a mass on a spring.		

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CHEMISTRY	Acid and Base	What do we drink?	pH electrode	Biochem, Gensci	Measuring the pH of different soft drinks.		
	Chemical reactions	Endothermic / Exothermic	Ext. Temp.	Biochem, Gensci, Physio	Performing different measurements to examine which reactions release or consume heat.	MS-PS1-6. Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.	HS-PS1-2. Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.
	Gas law	Boyle's law	Air pressure	Biochem, Gensci, Physio	Measuring the connection between volume and pressure: $PV=NRT$, by using a syringe to show the linear relation between volume and air pressure.		
	Heat Energy	Candle flame	Thermocouple	Biochem	Exploring the temperature zones of a candle flame.		
	Phase Change	Phase change	Ext. Temp.	Biochem, Gensci, Physio	A classic activity measuring the freezing and boiling point of water.	MS-PS1-2. Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.	HS-PS1-3. Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles. HS-ESS2-5. Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.
	pH titration	pH titration	pH electrode, Ext. Temp.	Biochem, Gensci	Classic Acid and Base titration - measuring pH and temperature change (Also using an external temperature sensor).		
	Specific heat	Specific heat	Ext. Temp.	Biochem, Gensci, Physio	Heating different liquids to the same temperature (70°C) and comparing the cooling curves of these liquids to explain which has the higher specific heat.	MS-PS1-4. Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.	HS-PS3-4. Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system.
	Spectrophotometry	Lamber Beer law	Turbidity	Biochem	Determining the relationship between a solution concentration and its light absorbance		

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Science field	Science topic	Labdisc Experiment				NGSS	
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BIOLOGY	Human body	Our heart rate	Heart rate	Biochem	Measuring the heart rate before and after exercise and recording useful information to determine physiological parameters.		HS-LS1-3. Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.
	Human body	Mammalian diving reflex	Heart rate	Biochem	Decreasing the heart rate when seeming in cold water to preserve body heat	MS-LS1-8. Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.	HS-LS1-3. Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.
	Human body	Sweat production	Humidity, Amb. & Ext. Temp.	Biochem, Gensci	Covering our hand with a plastic bag, while measuring temperature and relative humidity to explain the principle of the body's cooling system – sweat.		HS-LS1-3. Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.
	Human body	CO2 during respiration	External CO ₂ probe	Any Labdisc	Investigating bean seeds respiration, using the CO ₂ sensor.	MS-LS2-3. Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.	HS-LS2-5. Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.
	Plants	Photosynthesis is	Air pressure, Light	Biochem, Gensci	Recording air pressure and light level, while using an Elodea water plant sealed in a test-tube - to measure the effect of photosynthesis and the relation between light intensity and oxygen production by the plant.	MS-LS1-6. Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.	HS-LS1-5. Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.
	Plants	Photosynthesis is	DO ₂ electrode	Biochem	Using a DO ₂ sensor to check the Photosynthesis rate of an Elodea plant in different light intensities.	MS-LS1-6. Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.	HS-ESS2-6. Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.

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EARTH and SPACE SCIENCE	Atmosphere	Greenhouse effect	Amb. & Ext. Temp.	Biochem, Gensci, Physio	Building a small greenhouse and measuring the temperature inside and outside the greenhouse placed in a lighted area		HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
	Atmosphere	Altitude and Air pressure	Barometer and GPS	Biochem	Using the Barometer and GPS sensors to travel from high to low places, measuring the change in air pressure and altitude.	MS-ESS2-5. Collect data to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions.	
	Atmosphere	Walk in the park	Sound, ext. Temp., humidity	Gensci	Measuring the changes in noise, temperature and humidity in different urban areas.		HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
	Atmosphere	Green lungs	External CO ₂ probe		Study the effect plants and parks have on reducing the CO ₂ gas level in urban areas.	MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.	HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
	Atmosphere	Week temperature	Amb./ Ext. Temp.	Biochem, Gensci, Physio	Recording of temperature changes over a week. Using the results to predict weather in the coming days		
	Hydrosphere	Acid rain	pH electrode	Biochem, Gensci	Collecting rain in different area and verifying the acidity of the rain as it relates to pollution.		HS-ESS3-6. Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.
	Hydrosphere	Water quality	Turbidity	Biochem	Comparing drinking water turbidity to other water taken from lakes and ponds.		HS-ESS3-1. Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.
	Hydrosphere	Water Bodies	Amb. & Ext. Temp., Humidity	Biochem, Gensci	Measuring temperature and humidity near rivers or other water bodies to determine their effect on the environment.		HS-ESS3-6. Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.
	Space Science	Day and Night	Amb./ Ext. Temp., Light	Biochem, Physio, Gensci	Recording the variations of temperature and light during a period of 24 hours to establish relations between them.	MS-ESS1-1. Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons.	