LAB SIMULATIONS
SUMMARY

http://www.physicsinmotion.com

LAB 1.1 ORDERS OF MAGNITUDE
None for this lab assignment.

LAB 2.1 MEASURING TIME

  Learn about position, velocity, and acceleration graphs. Move the little man back and forth with the mouse and plot his motion. Set the position, velocity, or acceleration and let the simulation move the man for you.

LAB 2.2 ACCELERATION OF A CART
None at this time

LAB 3.1 GRAVITATIONAL ACCELERATION OF A PROJECTILE

- http://www.splung.com/content/sid/2/page/projectiles
- http://www.cloudequal.com/projectile-motion

LAB 4.1 MOTION AND FORCE

  Explore the forces at work when you try to push a filing cabinet. Create an applied force and see the resulting friction force and total force acting on the cabinet. Charts show the forces, position, velocity, and acceleration vs. time. View a Free Body Diagram of all the forces (including gravitational and normal forces).

  Explore the forces at work in a tug of war or pushing a refrigerator, crate, or person. Create an applied force and see how it makes objects move. Change friction and see how it affects the motion of objects.

- https://phet.colorado.edu/en/simulation/forces-1d
  Explore the forces at work when you try to push a filing cabinet. Create an applied force and see the resulting friction force and total force acting on the cabinet. Charts show the forces, position, velocity, and acceleration vs. time. View a Free Body Diagram of all the forces (including gravitational and normal forces).

LAB 4.2 COEFFICIENT OF SLIDING FRICTION

- https://phet.colorado.edu/en/simulation/friction
  Learn how friction causes a material to heat up and melt. Rub two objects together and they heat up. When one reaches the melting temperature, particles break free as the material melts away.

  Go to Mass Hanging Over Table Edge (mem2.) Set up several parameters, record the results and compare these results with the equations from the textbook CH-4.
LAB 5.1 WORK RELATIONSHIP IN THE INCLINED PLANE

- [https://phet.colorado.edu/en/simulation/the-ramp](https://phet.colorado.edu/en/simulation/the-ramp)
  Explore forces, energy and work as you push household objects up and down a ramp. Lower and raise the ramp to see how the angle of inclination affects the parallel forces acting on the file cabinet. Graphs show forces, energy and work.

  Explore forces and motion as you push household objects up and down a ramp. Lower and raise the ramp to see how the angle of inclination affects the parallel forces. Graphs show forces, energy and work.

LAB 5.2 CONSERVATION OF ENERGY

- [https://phet.colorado.edu/en/simulation/energy-skate-park](https://phet.colorado.edu/en/simulation/energy-skate-park)
  Learn about conservation of energy with a skater dude! Build tracks, ramps and jumps for the skater and view the kinetic energy, potential energy and friction as he moves. You can also take the skater to different planets or even space!

  Learn about conservation of energy with a skater dude! Explore different tracks and view the kinetic energy, potential energy and friction as he moves. Build your own tracks, ramps and jumps for the skater.

LAB 6.1 MOMENTUM AND RELATION TO FORCE

  Go to one D collision (mem2). Change the variables, create a data table and record the graphs.

LAB 6.2 COLLISION AND IMPULSE

- [https://phet.colorado.edu/en/simulation/collision-lab](https://phet.colorado.edu/en/simulation/collision-lab)
  Use an air hockey table to investigate simple collisions in 1D and more complex collisions in 2D. Experiment with the number of discs, masses, and initial conditions. Vary the elasticity and see how the total momentum and kinetic energy changes during collisions.

LAB 7.1 UNIFORM CIRCULAR MOTION

- [https://phet.colorado.edu/en/simulation/gravity-force-lab](https://phet.colorado.edu/en/simulation/gravity-force-lab)
  Visualize the gravitational force that two objects exert on each other. Change properties of the objects in order to see how it changes the gravity force.

  Move the sun, earth, moon and space station to see how it affects their gravitational forces and orbital paths. Visualize the sizes and distances between different heavenly bodies, and turn off gravity to see what would happen without it!

LAB 8.1 TORQUE AND FORCES ON A BEAM

- [https://phet.colorado.edu/en/simulation/rotation](https://phet.colorado.edu/en/simulation/rotation)
  Join the ladybug in an exploration of rotational motion. Rotate the merry-go-round to change its angle, or choose a constant angular velocity or angular acceleration. Explore how circular motion relates to the bug’s x,y position, velocity, and acceleration using vectors or graphs.

- [https://phet.colorado.edu/en/simulation/balancing-act](https://phet.colorado.edu/en/simulation/balancing-act)
  Play with objects on a teeter totter to learn about balance. Test what you’ve learned by trying the Balance Challenge game.
LAB 9.1 FLUIDS

  Experiment with a helium balloon, a hot air balloon, or a rigid sphere filled with different gases. Discover what makes some balloons float and others sink.

- [https://phet.colorado.edu/en/simulation/buoyancy](https://phet.colorado.edu/en/simulation/buoyancy)
  When will objects float and when will they sink? Learn how buoyancy works with blocks. Arrows show the applied forces, and you can modify the properties of the blocks and the fluid.

  Explore pressure in the atmosphere and underwater. Reshape a pipe to see how it changes fluid flow speed. Experiment with a leaky water tower to see how the height and water level determine the water trajectory.

LAB 10.1 BOYLE’S LAW

  Pump gas molecules to a box and see what happens as you change the volume, add or remove heat, change gravity, and more. Measure the temperature and pressure, and discover how the properties of the gas vary in relation to each other.

  This lab includes a worksheet which must be completed.

- [http://www.jdenuno.com/Chemistry/Labs/GasLaws.swf](http://www.jdenuno.com/Chemistry/Labs/GasLaws.swf)
  Go to the link for Boyle’s law and complete the activity. This will include the graph provided.

LAB 11.1 THERMAL CAPACITY AND SPECIFIC HEAT

None for this lab assignment.

LAB 13.1 SIMPLE HARMONIC MOTION – SPIRAL SPRING

- [https://phet.colorado.edu/en/simulation/normal-modes](https://phet.colorado.edu/en/simulation/normal-modes)
  Play with a 1D or 2D system of coupled mass-spring oscillators. Vary the number of masses, set the initial conditions, and watch the system evolve. See the spectrum of normal modes for arbitrary motion. See longitudinal or transverse modes in the 1D system.

- [https://phet.colorado.edu/en/simulation/mass-spring-lab](https://phet.colorado.edu/en/simulation/mass-spring-lab)
  A realistic mass and spring laboratory. Hang masses from springs and adjust the spring stiffness and damping. You can even slow time. Transport the lab to different planets. A chart shows the kinetic, potential, and thermal energy for each spring.

- [https://phet.colorado.edu/en/simulation/fourier](https://phet.colorado.edu/en/simulation/fourier)
  Learn how to make waves of all different shapes by adding up sines or cosines. Make waves in space and time and measure their wavelengths and periods. See how changing the amplitudes of different harmonics changes the waves. Compare different mathematical expressions for your waves.

LAB 13.2 SIMPLE HARMONIC MOTION – PENDULUM

- [https://phet.colorado.edu/sims/pendulum-lab/pendulum-lab_en.html](https://phet.colorado.edu/sims/pendulum-lab/pendulum-lab_en.html)
  Play with one or two pendulums and discover how the period of a simple pendulum depends on the length of the string, the mass of the pendulum bob, and the amplitude of the swing. It’s easy to measure the period using the photogate timer. You can vary friction and the strength of gravity. Use the pendulum to find the value of g on planet X. Notice the harmonic behavior at large amplitude.
LAB 14.1 SPEED OF SOUND IN AIR

- [https://phet.colorado.edu/en/simulation/sound](https://phet.colorado.edu/en/simulation/sound)
  This simulation lets you see sound waves. Adjust the frequency or volume and you can see and hear how the wave changes. Move the listener around and hear what she hears.

LAB 15.1 ELECTRICAL POTENTIAL

- [https://phet.colorado.edu/en/simulation/capacitor-lab](https://phet.colorado.edu/en/simulation/capacitor-lab)
  Explore how a capacitor works! Change the size of the plates and add a dielectric to see how it affects capacitance. Change the voltage and see charges built up on the plates. Shows the electric field in the capacitor. Measure voltage and electric field.

  Move point charges around on the playing field and then view the electric field, voltages, equipotential lines, and more.

LAB 17.1 OHM’S LAW AND RESISTANCE

  Learn about the physics of resistance in a wire. Change its resistivity, length, and area to see how they affect the wire’s resistance. The sizes of the symbols in the equation change along with the diagram of a wire.

- [vocals.com/circuits](http://vocals.com/circuits) (copy and paste this into your browser)
  Examine Ohm’s law by testing each resistor and changing the power supply (3 different settings). Record values in a data table including the equivalent resistance.

LAB 18.1 BUILDING CIRCUITS – SERIES AND PARALLEL

  This new version of the CCK adds capacitors, inductors and AC voltage sources to your toolbox! Now you can graph the current and voltage as a function of time.

  Build circuits with capacitors, inductors, resistors and AC or DC voltage sources, and inspect them using lab instruments such as voltmeters and ammeters.

  An electronics kit in your computer! Build circuits with resistors, light bulbs, batteries, and switches. Take measurements with the realistic ammeter and voltmete. View the circuit as a schematic diagram, or switch to a life-like view.

  Build circuits with resistors, light bulbs, batteries, and switches and take measurements with laboratory equipment like the realistic ammeter and voltmete.

- [vocals.com/circuits](http://vocals.com/circuits) (copy and paste this into your browser)
  Build all the circuit combinations (series and parallel) using two and three resistors and one power supply. Print out the results and a data table reflecting all of the values and equivalent resistance.

LAB 19.1 MAPPING MAGNETIC FIELDS

None at this time
LAB 19.2 STRENGTH OF A MAGNETIC FIELD

None at this time

LAB 20.1 ELECTROMAGNETIC INDUCTION and FARADAY’S LAW

- https://phet.colorado.edu/en/simulation/faraday
  Play with a bar magnet and coils to learn about Faraday's law. Move a bar magnet near one or two coils to make a light bulb glow. View the magnetic field lines. A meter shows the direction and magnitude of the current. View the magnetic field lines or use a meter to show the direction and magnitude of the current. You can also play with electromagnets, generators and transformers!

- https://phet.colorado.edu/en/simulation/faradays-law
  Light a light bulb by waving a magnet. This demonstration of Faraday's Law shows you how to reduce your power bill at the expense of your grocery bill.

LAB 23.1 PLANE MIRRORS AND THE LAW OF REFLECTION

- vocals.com/optics (copy and paste this into your browser)
  Click on plane mirrors and change the object to three different locations and heights. Print the three images and turn them in.

LAB 23.2 FORMATION OF IMAGES BY SPHERICAL MIRRORS

- vocals.com/optics (copy and paste this into your browser)
  Click on spherical mirrors (concave-converging) and move the object to: beyond 2f, at 2f, between 2f and f, at f, between f and the mirror. Change the mirror to convex (diverging) and obtain one image. Print all six images and turn them in.

LAB 23.3 CONVEX LENSES

- https://phet.colorado.edu/en/simulation/bending-light
  Explore bending of light between two media with different indices of refraction. See how changing from air to water to glass changes the bending angle. Play with prisms of different shapes and make rainbows.

- vocals.com/optics (copy and paste this into your browser)
  Click on convex lenses (converging) and move the object to: beyond 2f, at 2f, between 2f and f, at f, between f and the lens. Change the lens to concave (diverging) and obtain one image. Print all six images and turn them in.

LAB 24.1 DIFFRACTION GRATINGS

- https://phet.colorado.edu/en/simulation/blackbody-spectrum
  How does the blackbody spectrum of the sun compare to visible light? Learn about the blackbody spectrum of the sun, a light bulb, an oven, and the earth. Adjust the temperature to see the wavelength and intensity of the spectrum change. View the color of the peak of the spectral curve.

LAB 29.1 RADIOACTIVE DECAY

- https://phet.colorado.edu/en/simulation/alpha-decay
  Watch alpha particles escape from a polonium nucleus, causing radioactive alpha decay. See how random decay times relate to the half life.

- https://phet.colorado.edu/en/simulation/beta-decay
  Watch beta decay occur for a collection of nuclei or for an individual nucleus.
http://mrmaloney.com/mr_maloney/simulations/sims.html
Go to Random Coin Flipping (compare). Change the amount of coins and collect the graphs generated.