

PHYS1003/1004/1902 Experimental Labs

Project Suggestions, Semester 2, 2013

The following list comprises possible project topics that have been done previously, using easily obtained materials and equipment in the labs. Groups are welcome to come up with their own ideas, but if they are struggling for a topic, you can pull out some of these as suggestions.

Thermal Physics

- a) Insulating properties of coffee cup: compare thermal insulation properties of cups made of various materials.
- b) Calorimeter: thermal properties of various objects.

Fluids

- a) Viscosity: using a stopwatch or video analysis to determine the rate of fall of an object through a fluid or through various fluids.
- b) Viscosity: using a rotational viscometer by measuring the torque required to rotate a disk in a liquid at a known speed.
- c) Liquid flow: how it depends on the properties of the tube through which it is flowing.
- d) Liquid flow: simulating the partial blockage of an artery by placing a small blockage in a tube and measuring the changes in the flow of the liquid.

Nuclear Physics

- a) Radioactive shielding: use alpha, beta, and gamma sources and determine the effects of shielding and distance on the count rate
- b) Radioactive decay: determine the radioactive decay half-life of a solution passed through a Cs 137 – Ba 137 isotope generator.

Electromagnetism

- a) Induction, eddy currents: a range of experiments including dropping magnets through various solenoids, dropping magnets through non-ferrous pipes inducing eddy current, constructing transformers.
- b) Measure the charge to mass ratio of the electron.
- c) PE Effect: use the photoelectric effect to measure Planck's constant.
- d) Internal resistance of a battery: measure how the internal impedance changes with time and the type of battery.

Properties of Electromagnetic Waves

- a) Reflection, interference, and refraction of microwaves
- b) Diffraction of light: from a laser by single, double and multiple slits
- c) Spectra of light: using Ocean Optics apparatus to measure the spectrum of various light sources and filters.
- d) UV absorption: of various roofing materials and comparison with manufactures specifications.
- e) Infrared radiation: estimate Planck's constant by measuring the variation of radiation from a quartz halogen lamp.
- f) Refractive index of a sugar solution: change the concentration of sugar in a solution and measure the deviation of a laser beam passing through it.
Given these results measure the sugar concentration in an unknown solution (e.g. lemonade)

Sound and Waves Experiments

- a) Vibrating wire: measure the resonant frequencies of various wires and compare with theory.
- b) Loudspeaker: measure the frequency response of a speaker and compare with manufacturers specifications.
- c) Musical instruments: fourier analysis of musical instruments or recorded sounds.

Renewable Energy and Energy Efficiency

- a) Solar cells: determine the efficiency and characteristics of solar cells of various types.
- b) Efficiency of light globes: quartz halogen, incandescent, energy saving globes, LEDs.
- c) Wind powered generator: determine the efficiency of a wind powered generator.

Mechanics

- a) Collisions: using a low friction air track and Vernier Motion apparatus.
- b) Walking and running: analysis using a force plate and video point software.
- c) Large amplitude pendulum: measure the period and compare with theory.
- d) Sporting equipment: elasticity of tennis, squash, or basket balls, using a force plate. Sweet spot of baseball bat, tennis racket etc.
- e) Aerodynamics: determine the effect of profile, air speed, lift, angle of attack of an aeroplane wing.

Medical Physics

- a) Artery blockage and blood flow using fluid apparatus.
- b) Ultrasound: measuring acoustic properties of solids and liquids using ultrasound equipment (see MRTY course)
- c) X-ray properties: attenuation, scatter, imaging