ND LIGHTS DONATION PACKAGES – SPRING 2013

#1 Studying the relationship between enzyme structure and function using papain

Donated Equipment: Statfax-2100 microplate reader (with computer and printer)
Donated VWR materials: heat block, microplates, pipettors and tips, microcentrifuge tubes and rack, spatulas

Papain is a protease, an enzyme that digests protein. It is found in meat tenderizers, pineapples, and papaya. In a two-part experiment, students will learn to quantify the amount of enzyme/protein in a solution by the Coomassie Blue staining method and generate a standard curve based on absorbances read by a microplate reader. After determining the concentration of papain, protein in the form of whey protein powder is added and the changes in absorbances can be observed. The activity of papain at high temperatures and acidic and basic solutions will also be observed by monitoring changes in absorbance. High school students with a general understanding of chemistry and molecular biology will be introduced to basic analytical chemistry techniques and biochemistry concepts. They will observe the relationship between enzyme structure and activity while building standard curve development techniques and learning to work with microscale equipment.

#2 Are raw or boiled vegetables better for you?

Donated Equipment: Thermal Cycler
Donated VWR materials: TLC plates, plastic pipets, microcentrifuge tubes, UV lamp, spatulas, chemicals

Vegetables are valuable sources of vitamins your body needs to function. How does the vitamin content of the veggie change depending on how you cook it? Is raw better than boiled? In this experiment, students will monitor the presence of vitamins in water by designing a simple experiment to answer these questions. Appropriate for high school students and adaptable for students of younger grades, this experiment introduces students to the basic separation technique of thin-layer chromatography (TLC), often used in organic labs. A thermal cycler is included to vary temperatures incrementally.
Note: Thermal cyclers are essential to the PCR process. This piece of equipment could also be used to accommodate a PCR experiment.

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#3 Gel Electrophoresis Run Prediction

Donated Equipment: Power supply, Gel Boxes, (Programmable Thermal Cycler*)
Donated VWR materials: Automatic Pipettors (p10s), pipette tips, microcentrifuge tubes, microcentrifuge tube racks, weigh boats, 250 mL beakers, TBE buffer, agarose, dyes

In this experiment, students will be introduced to and become familiar with gel electrophoresis and how it separates material based on size and charge. Students will be taught about how smaller particles move farther and how the charge on the particles dictates which direction they will travel. They will then be shown the particles that they will use and be asked to predict how they each will travel across the gel.

Electrophoresis is a very common and vital technique in many lab experiments, including DNA profiling for forensics. To have a firm knowledge and understanding of how it works is imperative for anyone entering any scientific field—it is used multiple times throughout labs in a college career. Also, having the tools will enable a school to perform many PCR reactions which opens up a whole new window of possibilities.

*The programmable thermal cycler is not used in the designed experiment but will be donated to the recipient school for potential future use with the donated gel equipment (i.e. in a PCR experiment, such as a forensic DNA study).

#4 Brine Shrimp Viability in Variable pH Levels

Donated Equipment: pH meters with new electrodes
Donated VWR materials: petri dishes, beakers, transfer pipets, magnifiers, test tubes, test tube racks, HCl, NaOH

Student pairs will have 5 test tubes and will use NaOH and HCl to raise and lower the pH of each tube. Students should predict what kind of environment they think will provide the best chance of life of brine shrimp and why. With increasing levels of CO_2 in the environment, rain is becoming more and more acidic which eventually can lead to higher acidity levels in water. This experiment can help show what effects that may have in aquatic life in the future.

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#5 Light Transmittance of Red Kool-Aid

Donated Equipment: Photoelectric Colorimeter
Donated VWR materials: Polypropylene Beakers (400mL), Test Tubes and Racks, Plastic Pipets, Lint-free wipes

This experiment is appropriate for a junior or senior level chemistry course. It provides an introductory understanding of the Beer-Lambert Law, a physical description of the relationship between concentration of a solution and the amount of light that can be transmitted through the solution. Students will use a Photoelectric Colorimeter to measure and record the transmitted light through various concentrations of red Kool-Aid. The recorded data will then be plotted and graphed. The derived linear model will then be used to determine the concentration of Kool-Aid in an unknown solution by observing the amount of light transmitted through the unknown solution. This experiment provides students with a fundamental understanding of colorimetry, an opportunity to make serial dilutions, and the practice of deriving mathematical models to determine properties of unknown substances.

#6 The Dirt on pH for Plants

Donated Equipment: Three pH Meters, Mixed Soil, Seeds, Miracle Grow Plant Food, Ring Stand and Funnel Platform
Donated VWR materials: pH Electrode, Glass Beakers (600mL), Glass Fill Funnels (150mm top diameter), Glass Stir Rods, Griffin Beakers (400mL)

This biochemistry experiment is appropriate for an AP Chemistry or Biology Course. The primary objective of the experiment will be to help students understand the importance of pH as an environmental factor in biological systems. Students will make soils of different pH's. The pH of each soil will be measured using a pH electrode and a pH meter. Then, students will plant the same species of seed in each soil environment and observe growth. The pH of each soil will be observed throughout the growth process by measuring the pH of the soil runoff after watering the plant. This multi-week experiment provides students with a fundamental understanding of biochemistry, practice in using a pH meter and electrode, and the opportunity to consider the affects of soil pollution on organisms.

INTERESTED HIGH SCHOOLS MAY APPLY FOR A SPECIFIC DONATION PACKAGE BY SUBMITTING A BRIEF STATEMENT OF NEED TO DR. MICHELLE JOYCE AT mjoyce@nd.edu. RECIPIENT TEACHERS MUST BE AVAILABLE FOR ON-SITE TRAINING AT THE UNIVERSITY OF NOTRE DAME AT THE END OF APRIL OR THE BEGINNING OF MAY 2013. DONATION TRANSPORTATION IS THE RESPONSIBILITY OF THE RECIPIENT SCHOOL.