DYE-SENSITIZED SOLAR CELLS

Nanotechnology for Energy Conversion

Can we harvest the sun's vast energy using nanoparticles to fabricate inexpensive, next generation solar cell devices?

Students use nanotechnology and plant pigments to fabricate an artificial photosynthetic device for capturing the sun's energy and convert it to electricity. They are then challenged to design the most efficient dye sensitized solar cell using vegetable or fruit dyes.

By incorporating everyday materials into science lessons, the Materials World Modules (MWM) program at Northwestern University has found the solution to getting students excited about learning science while helping teachers meet national and state education standards.

The modules are easy to organize and inexpensive to use. They can be incorporated into any science class because of the breadth of subjects covered in the Activity and Design Project sections. Each module is a supplemental science unit that takes 1-3 weeks of class time (ideally, approximately 10 hours) to complete.

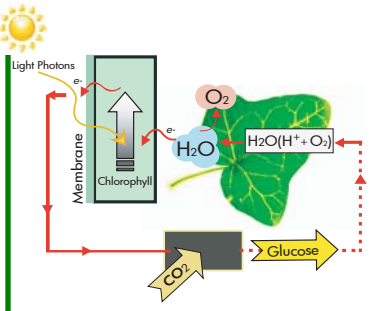
Module At-a-Glance:

Activities

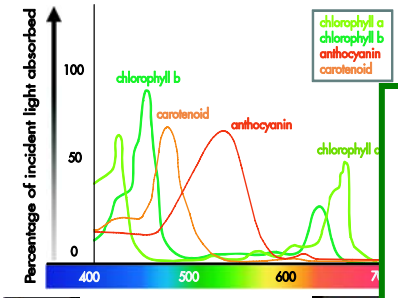
- Investigating the Photosynthesis of Spinach Leaf Discs
- Separating Leaf Pigments Using Paper Chromatography
- Measuring Silicon Solar Cell's Performance
- Making a Spinach Dye Sensitized Solar Cell

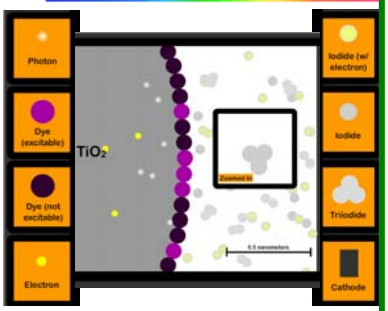
Design Project

- Designing a Dye Sensitized Solar Cell with Maximum Power Output



MWM will give students an opportunity to understand the world around them in a way they have never experienced before. The modules promote an awareness of the roles science and technology play in society and guide students to take increased control of their work.





MWM is designed to improve STEM education

Science ▪ Technology ▪ Engineering ▪ Math

Interdisciplinary
Integrates science & non-science subjects

Flexible
Can adapt to your teaching style, students' ability and class time

Hands-on
Contains activities that lead up to inquiry-centered design projects

Cutting-edge
Examines issues on the forefront of technological research

Connects to Your Curriculum

Chemistry
Atomic Structure ■ Bonding ■ Polarity ■ Redox Reactions ■ Rates of Reactions ■ Chromatography ■ Solutions, Colloids, and Suspensions ■ Hydrocarbons■ Catalyst ■ Electrochemistry

Biology & Life Sciences
Cell Processes ■ Photosynthesis ■ Energy Pathways ■ Ecosystems ■ Carbon Cycle ■ Food Web ■ Decomposition

Mathematics
Orders of Magnitude ■ Size and Scale ■ Surface-to-Volume Ratios ■ Graphing (Making, Reading and Interpreting) ■ Averages ■ Rates

Physics & Physical Sciences
Electromagnetic Waves ■ Colors and Light ■ Capillary Forces ■ Circuits ■ Electron Flow/Current ■ Photoelectric Effect ■ Energy, Work, and Power ■ Energy Source

Geology & Earth Science
Metals■ Rocks and Minerals ■ Use of Natural Resources ■ Renewable and Nonrenewable Resources ■ Solar Energy

Technology/Engineering Education
Iterative Design ■ Building Prototypes ■ Optimization ■ Communications

Society
Ethics and Impact of Uses of Nanotechnology

Language Arts
Public Speaking ■ Writing a Scientific Paper

Materials World Modules
An Inquiry & Design Based STEM Education Program
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