

HANDS-ON EXPERIMENTS FOR 2ND LEVEL STUDENTS

1) Gigantic STM measurement experiment

Is it possible to “see” atoms? How do scientists “see” in the nanoworld? Scanning Tunneling Microscopy (STM) is used to investigate the structure of nanomaterials. In this experiment the students will understand the fundamentals of how an STM works and how it is possible to determine the structure of a molecule lying on the surface of a material. The experiment is setup as a friendly competition to see what student team is the first to discover the “hidden molecule” in their sample.

Developed by: Christian Wirtz, 2012

2) Shining light with molecules: an experiment in energy conversion

Organic devices are one of the frontiers in modern electronics; the basic concept is that of using organic molecules or polymers in order to generate light. How is it possible to use a molecule to generate light? Is it difficult to do? In this experiment the students will build a basic organic flexible device that produces light. They will build everything from the electrical contacts to the optimisation of current and voltages to get the best “shine”.

Developed by: Colm Delaney, 2012

3) Challenges for fuel cells: an experiment in electrocatalysis

One of the greatest challenges for the use of fuel cells in everyday applications is that of generating hydrogen and oxygen from water efficiently. This can be done but at tremendous cost, due to the use of metals that are rare and expensive. Could it be done with cheaper and more abundant metals? How would you test what metals you can use to generate hydrogen from water? In this experiment the students will setup a simple experiment that illustrates how different metals can promote water splitting for the generation of hydrogen.

Developed by: Ian Godwin, 2012

4) Greener than spinach: porphyrins in our daily lives

Porphyrins are everywhere! These molecules play important roles in nature and they have a wide range of applications, from energy conversion to medical treatments. They all share a common basic molecular structure but their function can change dramatically depending on small modifications of their scaffold. In this experiment the students will crush and grind common spinach to extract and isolate chlorophyll, probably the most famous porphyrin of all.

Developed by: Hans Eckhardt, 2012

5) Metal surfaces for pollution control: an experiment in structure visualisation

What reactions take place in a catalytic converter? Could catalytic converters be improved? What challenges must be overcome to do so? These devices improve air quality thanks to the chemistry occurring at the surface of small metallic particles. In this practical students will learn to visualise various metal surfaces and will rationalise why certain surfaces can facilitate reactions that are important for controlling environmental pollution.

Developed by: John Carey, 2012