

Biochemistry—The Molecules of Life— Demonstration Summaries and Concepts



Membrane Diffusion—Dialysis Demonstration

How does the membrane around a cell help to regulate the internal makeup of the cell? This demonstration compares the diffusion of small and large molecules across a semi-permeable membrane to illustrate the process of diffusion in cells. Dialysis tubing is used to model the behavior of a cell membranes with respect to the sizes of the molecules that will or will not diffuse through them. Chemical tests reveal that sodium chloride is small enough to pass through the membrane, but that starch is too large.

Glucose Fermentation—Metabolism Demonstration

The overall products of the fermentation of glucose, the main carbohydrate in fruits and grains, are ethyl alcohol and carbon dioxide. Many different intermediate products may also be formed depending on reaction conditions. In this demonstration, an acid–base indicator is used to detect the production of carbon dioxide, and a redox indicator is used to illustrate the changing reaction conditions during the fermentation process. An optional distillation procedure is also provided to identify ethyl alcohol in the product mixture.

Lactose Intolerance—Enzyme Digestion Demonstration

Many people are said to be “lactose intolerant.” These people are unable to digest milk and dairy products because they lack the enzyme required to break the linkage joining the two monosaccharide units in lactose (milk sugar). In this demonstration, yeast is used as a model lactose-intolerant organism to illustrate the use of a commercial enzyme product called Lactaid™ in milk digestion.

Amino Acid Fingerprints—Ninhydrin Demonstration

Latent fingerprints are composed of several chemicals that are naturally present in skin oils or released through the pores of the skin via perspiration. Both amino acids and peptides are normally found in the natural oils on skin. These compounds react with a special reagent, called ninhydrin, to give a characteristic purple product. Detectives use ninhydrin to reveal fingerprints left behind at crime scenes. This demonstration simulates the use of ninhydrin in forensic chemistry to detect latent fingerprints on porous surfaces, such as paper and cloth.

pH and Protein Solubility—A Reversible Demonstration

Any changes in the pH of a protein’s environment will cause observable changes in the solubility of the protein. These changes occur because proteins contain many acidic and basic groups that have different structures at different pH values. This demonstration looks at the reversible solubility behavior of casein, the principal protein in milk, as hydrochloric acid or sodium hydroxide is added to the protein. The structure of the protein at different pH values is discussed.

Concepts

- Semipermeable membrane
- Diffusion
- Dialysis

- Carbohydrates
- Glucose
- Fermentation

- Lactaid™
- Lactose
- Disaccharide
- Monosaccharide

- Amino acids
- Ninhydrin
- Forensic chemistry

- Proteins
- Isoelectric point
- Solubility
- pH