



LEARNING MODULES

GK-12 DISSECT at New Mexico State University

Title: Info Graphics

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Discipline or Area: 3D Modeling

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School: Arrowhead Park Early College High School

Subject of class: Chemistry

Grade: 9th

COVERAGE OF COMPUTATIONAL TOPICS

The concepts of data abstraction and modeling are at the core of this lecture. Students are learning the fundamentals of atomic structure and properties and how this relates to the world around them. Through various models including StarLogo, 3D Doodler, marshmallow and stick, and ball and stick, students gain a deeper understanding of the functionality of atomic and molecular structure.

OBJECTIVES

Students learn the strengths and weaknesses of various models. Students will learn how information technology can be harnessed to gain a deeper understanding of reality. The idea behind abstraction, how specific observations and experiments are generalized into theory, will be understood.

EQUIPMENT AND MATERIALS

Instructions on various models
Computer with projector
Ball and stick models
Marshmallows and sticks
3D Doodler with wax

BACKGROUND AND REFERENCES

Students are learning the basic principles behind atomic and molecular structure. This includes concepts such as atomic number, molecular weight, valence electrons, orbitals, subatomic masses (neutrons, electrons, and protons) and their electromagnetic properties (charge). These fundamentals are abstract, especially for a high school audience, so models can help facilitate learning.

PROCEDURE

Provide detailed instructions on how this module is taught.

This lecture can be taught within a single day. The instructor begins by providing a general review of atomic theory. This portion lasts around 15 to 20 minutes. It is important that students are familiar with neutrons, electrons, protons, atomic mass and how it is calculated, and the overall structure of an atom. Once this review is concluded, students are asked several different assessment questions to ensure their comprehension. Upon completion, computational thinking terminology is introduced such as abstraction, modeling, and algorithms. The process of science can be included into this portion to describe how scientists perform a series of experiments and observations and if general results are obtained, general theories can be formulated. Also, during the calculation of atomic mass, it should be explained to students how this process is an algorithm or sequence of steps. CT teachers can show StarLogo models of neutral atoms and molecules on a projector to segue into the next series of activities and also to incorporate information technology into the lecture.

Students are then divided into different groups and the instructions for each module activity are presented. Each student is also provided with a reiteration of these instructions. At each table, students are asked to use the materials provided (Ball and stick models, Marshmallows and sticks, 3D Doodler with wax) to create models of requested atoms and molecules.

What were the “learning goals?”

Students will reinforce their chemistry concepts. Students will learn how computational thinking supports acquisition of a broad range of knowledge. Students will become acclimated to data abstraction. Students will be familiarized with StarLogo.

How did you introduce CT?

CT concepts were introduced by explaining how the process for deriving molecular weight follows a comprehensible algorithm. Also, the importance and underlying idea behind models is explained via

several different media. Also, through the inclusion of Starlogo, students interact with informational technology in an interactive manner.

How could you assess the understanding of CT in this module?

NOTES AND OBSERVATIONS

What were challenges you encountered in the overall development of the module?

At times the students seemed uncomfortable or unfamiliar with the chemistry terms. This necessitated additional time reviewing the topic.

What was successful?

The interactive nature of modeling was enjoyable for the students. I believe it helped the students to more tangibly understand the chemistry topic. Also, some of the more adventurous students ate the marshmallows!!

How was the students' reception to the content of the module?

Generally, they enjoyed it. They found it fun to interact with the various models.