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Safe Imaging of Internal Organs

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Grade Level: 11-12

Subject / Content area: Chemistry & Calculus

Unit of Study: Related Rates and Solubility

Lesson Title: Barium Contrast/Achalasia

Central Focus for the learning segment: How do doctors image internal organs safely and diagnose some medical aliments?

Content Standard(s): NYS CCLS or Content Standards (List the number and text of the standard. If only a portion of a standard is being addressed, then only list the relevant part[s].)

NYS Physical Setting\Chemistry Standards:

- Key Idea 5: Energy and Matter interact through forces that result in changes in motion. 5.2 Students will explain chemical bonding in terms of the behavior of electrons ii. Compare the physical properties of substances based on chemical bonds and intermolecular forces e.g., conductivity, malleability, solubility, hardness, melting point, and boiling point.
- 3.1w Elements can be differentiated by physical properties. Physical properties of substances, such as density, conductivity, malleability, solubility, and hardness, differ among elements
- V.8 A solution of homogeneous mixture of a solute dissolved in a solvent. The solubility of a solute in a given amount of solvent is dependent on the temperature, the pressure, and the chemical natures of the solute and solvent.

AP Calculus Standards:

- APC.8 The student will apply the derivative to solve problems. This will include
  - Modeling of rates of change and related rates

Learning Objectives associated with the content standards:

- Some students will be able to accurately calculate the amount of sodium sulfate to add to a solution of barium sulfate in order to bind all barium and accurately independently create and solve related rate questions.
- Most students will be able to calculate the amount of barium sulfate needed for the contrast solution and correctly set up the related rate equation
- All students will be able to use the model to describe the common ion effect and will demonstrate the correct use of the derivative and volume formulas

Instructional Resources and Materials to engage students in learning**:** Computer/Laptop with Agent sheets software, Agent sheets model, worksheet, writing utensil, calculator
Pre-Reading Assignment : http://www.lenntech.com/periodic/elements/ba.htm
https://www.rcr.ac.uk/docs/patients/worddocs/CRPLG_swallow.doc
In-Class Video Visual: http://www.youtube.com/watch?v=fCQ_MrhhGvI

Differentiation and planned universal supports to support diverse student needs:

Students who complete assigned work rapidly will be asked to create their own related rate questions and will be briefly shown the underlying functions of Agent sheets and asked to improve the computational model, or create one of their own.

Type of Student Assessments and what is being assessed:

- **Informal Assessment:** Participation in activity model and completion of instructed questions on worksheet

- **Modifications to the Assessments:** This lesson has numerous opportunities for higher preforming students to be further challenged or lower preforming students to be remediated.

Lesson Timeline:

Time	Teacher Actions	Student Actions
0:00-7:00	Introduce central focus topic.	Explore provided background materials.
7:00-10:00	Class discussion, show video demonstrating barium swallow	
10:00-17:00	Facilitate student work, Answer student questions.	Calculate mass of barium sulfate needed for solution.
17:00-27:00	Assist student exploration of model.	Explore model to determine second salt to add to solution.
27:00-34:00	Model calculations and answer student questions.	Calculate the amount of sodium sulfate to add.
34:00-45:00	Diagram related rate problem and assist set-up and solving numerically when needed.	Set-up and solve related rate problem in order to diagnose patient.