Grant Application for Anita Lotti – Westborough High School, Westborough MA

Subject: Chemistry	**Topic:** Reaction Types
Grade Level: 11	**Level:** College Preparatory Chemistry
Time Required for lesson: 56 minute period	**Equipment Required:** Test tubes, chemicals for reaction types, Portable Gooseneck Document Camera (similar to AVerVision CP150), tablet computer, projector

Objectives for Student Learning. At the end of the lesson students should be able to…

- identify the four indicators that a chemical reaction is occurring: formation of a gas (bubbling), formation of a precipitate (solid forms), change in energy (heat or light), or a change in odor
- identify a reaction as combination (synthesis), decomposition, single-replacement, double replacement, or combustion.
- use the reaction series of metals and nonmetals to predict single replacement reactions.
- predict the products of combination (synthesis), decomposition, single-replacement, double replacement, and combustion reactions.

Alignment to Content Standards. Massachusetts DOE Curriculum Frameworks for High School Chemistry (2006)

5.2. Classify chemical reactions as synthesis (combination), decomposition, single displacement (replacement), double displacement, and combustion.

Prerequisites. At the start of the lesson, students are able to do the following:

- Write a chemical formula when given the name of the compound.
- Balance a chemical equation.

Set-up. Prior to class, teacher will set up a series of small scale reactions in test tubes. Each reaction will represent one of the types that are being studied in the objectives.

- Single replacement: zinc plus tin chloride
- Double replacement: calcium chloride + sodium carbonate
- Synthesis: calcium oxide + water
- Decomposition: dehydration of sugar with sulfuric acid (done in fume hood)
- Combustion: burning of methane (done in fume hood)

Current Learning Process. Traditionally these demonstrations are performed by the teacher at the front of a class room containing about 25 students.

- Students are asked the following questions for each reaction:
    - Describe what is happening in the demonstration (list qualitative observations).
    - List the indicators that a chemical reaction is occurring.
    - Identify the type of reaction occurring and predict the products that will form (this is done together as a class).

The test tubes used for the reactions are small, and it is VERY difficult for

students to observe what is happening in each reaction. Previously, the teacher would walk around to each student with the test tube, but by the time the tube got to the last student, the reaction would have already gone to completion.

The image above represents the actual size of the demonstrations as they are currently done. Reaction tubes must be carried from student to student – which prevent simultaneous observations by all students. (Note: reactions done in fume hood are not walked around.)

Updated Process using an AVervision Portable Gooseneck document camera:

- The AVervision Camera will be attached to the existing tablet computer and projector at the front of the classroom.
- Each reaction will be performed by the teacher underneath the document camera (this excludes ones performed in fume hood for safety).
- As each reaction proceeds, the enlarged image from the AVervision document camera will be projected onto the board in the front of class, enabling all students to make their observations simultaneously
    - Voice description of process would also be recorded using the audio recording feature of the AVervision camera.
- On the big screen, students would be able to identify the formation of a precipitate, the formation of gas, and changes in energy using a Vernier temperature probe placed in the reaction vessels.
- Once complete, images can be stored and edited using a tablet computer to draw students' attention to key aspects of each reaction.
- Ex: The reaction between zinc and tin produces a gas and lots of bubbling. The temperature of the reaction tube gets warm and eventually the solid zinc gets replaced with solid tin. Students love this demonstration because it changes one solid metal into another solid

metal. The image of the bubbling and fizzing that occurs would be projected on board. The image can be annotated using the tablet computer as follows:
    - Compounds that are in solution can be identified ($SnCl_2$ and HCl).
    - Compounds in the solid form can be identified using arrows and labels.
    - Reactions can be written directly on the image to correlate what students have learned with what they are observing.
        - $Zn + SnCl_2 + HCl \rightarrow ZnCl_2 + H_2 + Sn$
        - Actual atoms can be drawn in and rearranged to show exactly what is happening as it occurs.
- Reaction images and the corresponding audio file can also be stored and uploaded to the class website for absent students to download or for students to review after class while answering homework questions.

This what the demonstration could like with the enlarged images from the AVervision document camera. (Images created using Smartboard notebook software and tablet computer.)

Benchmarks of Student Success.

In chemistry, students typically have trouble relating what they learn on paper to what they see in real life. The AVervision document camera would enable us to enlarge the real life demonstrations and annotate the images to correlate the reaction to the objectives students are learning. I believe this will improve student learning in the following ways:

- Increase understanding of the five different reactions types.
- Increase understanding of chemical changes and the associated indicators that a reaction is occurring.
- Allow for application of what they learn about reaction types to other real life chemical examples.

Student success will be measured using the standard paper and pencil test. In addition, students will be given an image of an unknown reaction (taken by the teacher using the document camera) and asked to identify the reaction indicators and the type of reaction occurring.

This type of assessment was not possible in previous years because of the limited discussion of demonstrations and the inability to upload reaction images, but it shows a deeper level of understanding by being able to apply learning directly to real life examples.

Notes on Chemical Waste and Safety. The AVervision Portable Gooseneck Document Camera would also improve both teacher and student safety.

- Demonstrations can be limited to small scale test tubes.
    - Reduces the need to purchase expensive and potentially dangerous chemicals.
    - Reduces chemical waste and the resulting problems of disposal.
- Reactions previously done by all students as a lab activity can now be done as a class at the front of the room.
    - Limits student exposure to potentially hazardous chemicals.
    - Reduces need for time-consuming lab activity set-up
    - Reduces chemical waste generation.

Lesson Plan written by:

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