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Lesson Plans

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Symmetry and Duplication

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NAS 501
Final Project – Integrated Lesson Plan – Science Component

Grade level/Subject taught: 11th and 12th Grade Local Chemistry, Math
Objectives: After using the models that we have constructed in Interactive Physics, and using the TI84+ Silver Edition graphing calculator, students will have a greater understanding of the concept of balancing equations.

Key Idea taught:
Balancing Equations of all types, particularly the ones found in Chemistry and Math class. (This is a required component of each curriculum.)

We have built two different models using Interactive Physics – one is a science scale, and one is of a math scale. The models actually represent the equation that is being balanced. This lesson plan will focus solely on the Science scale.

In the science scale model, there is a balance with two weighing pans – one has two blocks, the other only has one block. The pan with two blocks is supposed to represent two different elements. The red block represents Element X, and the yellow block represents Element Y. On the other pan, there is an orange block, and that is supposed to represent the combination of Elements X and Y to make Compound XY.

The model looks like this:
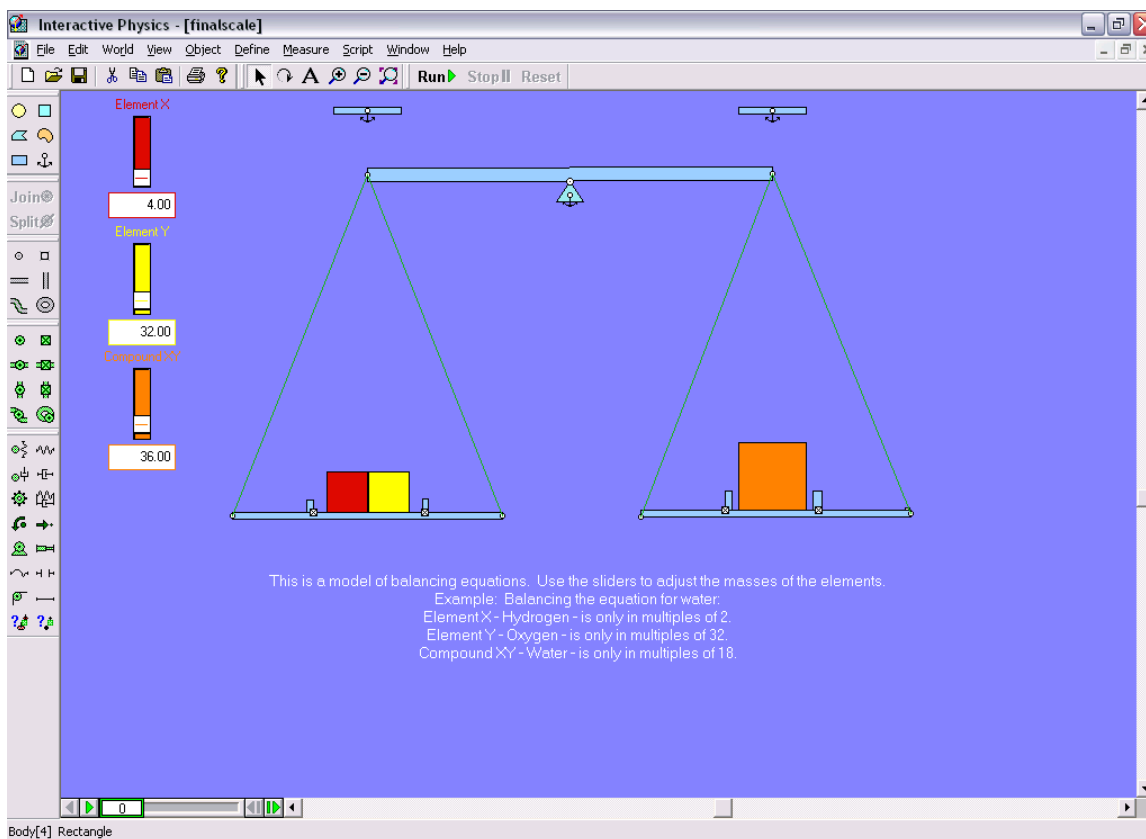
The sliders are used to adjust the mass of Element X, Element Y, and Compound XY. In the directions, it shows the students how the scale works, and gives a simple example.

Before I would use this model in class, I would show the students several examples of unbalanced equations, and see if they could figure out what was wrong. I would have them do this as a journal entry for the day – a warm-up to the class. After approximately ten minutes, I would have the students come back together as a class, and we would go over the equations, and work through balancing them properly. This would take another ten minutes or so. I would then ask the students if they would like a better way to picture balancing equations. I assume that they will all want to see this. I will then project the model on the screen using the LCD projector. I would start the model out using zero for all of the values. (This way it will balance!) When I run the model, the scale will not move. I would then change all of the values and run the model again. This time, the scale will not balance, and it will fall to the heavier side, like this:
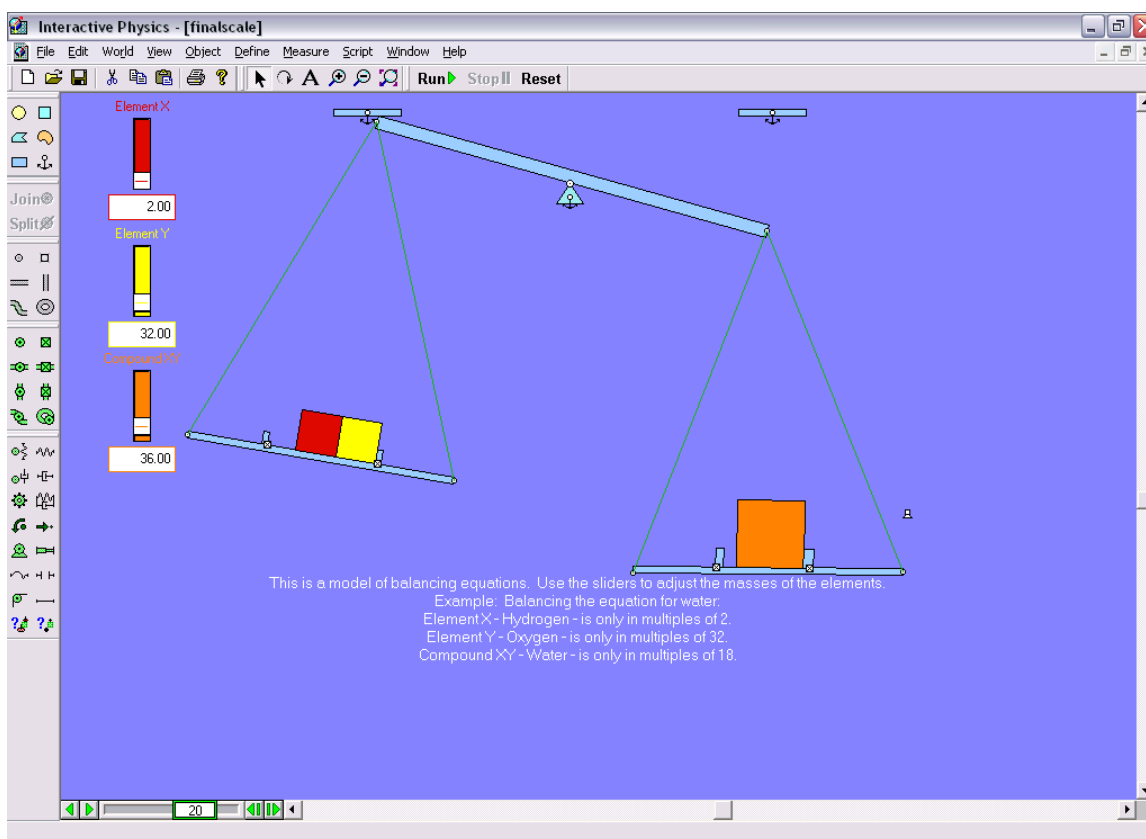
My challenge to the students would then be to list the same chemical formulas on the board, and have them work through this using the actual masses of all of the elements. It will be interesting to see the students work through the model using different values. I think that this will really help to solidify this concept.

Over the next few classes, I would plan to review balancing equations, and then branch into more complex equations. This would be a good way to move into the concept of Stoichiometry without scaring the students. (Most get scared when they hear the name, not to mention that it deals with equations and conversions!)

My rubric to grade this particular activity would be as follows:

Target	Acceptable	Unacceptable
Student accurately obtains data for interpretation	All data correlates to in-class model	Data does not correlate to in-class model
Student shows understanding of the concept of balancing equations.	Student is able to correctly balance the equations provided in the worksheet.	Student is not able to correctly balance the equations provided in the worksheet.
Student shows understanding of computer model.	Student accurately identifies ways to modify and improve the current model.	Student is unable to identify any possible changes to the current model.
Student expresses their thoughts and can apply knowledge gained in the virtual lab activity	Conclusion and analysis questions are well written, accurate, concise, and grade level appropriate	Conclusion and analysis questions are not well written, accurate, concise, or grade level appropriate

Balancing Equations Lab   Name: _____

Today we will be practicing balancing equations using a computer model that I have built
in Interactive Physics.

To begin, you should see a screen that looks like this:
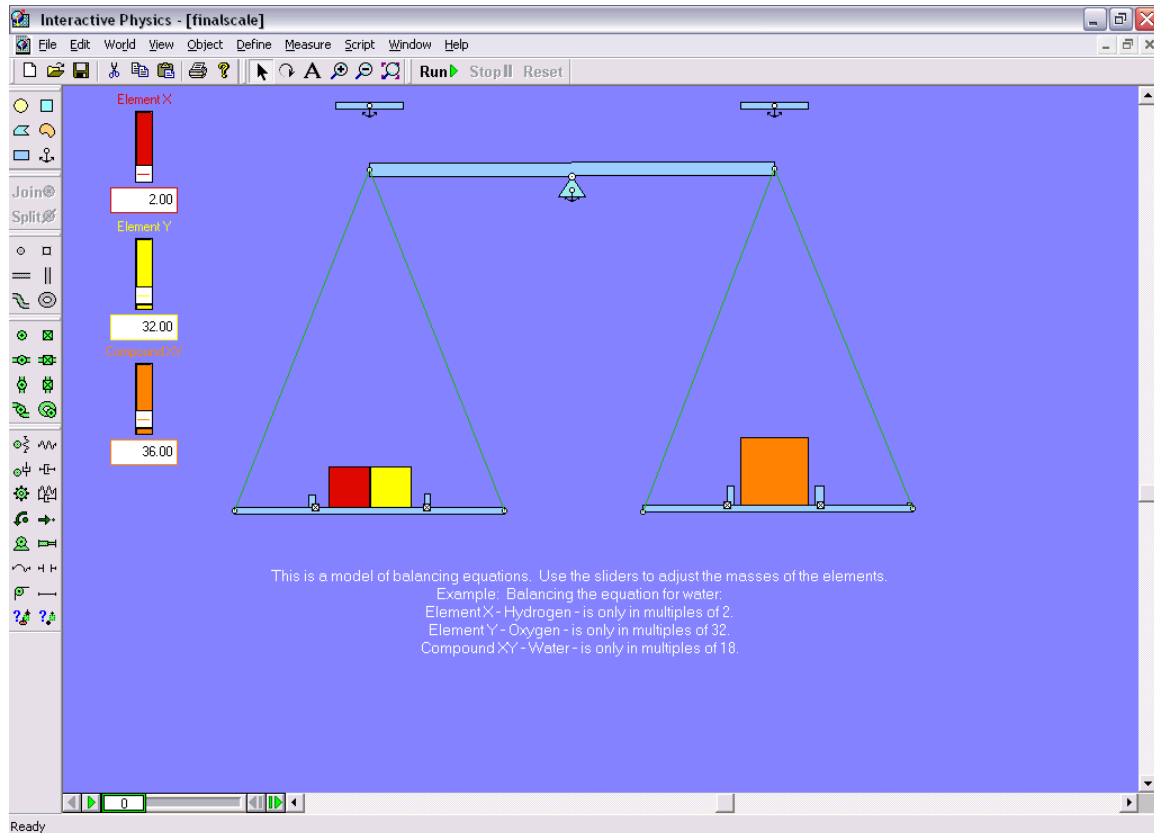
As you can see, there is a scale, and three different blocks.

What do the different blocks represent?
        Red:

        Yellow:

        Orange:

What is the purpose of the slider bars?

Why does this accurately represent balancing equations?

Our first equation to be balanced is the combination of Hydrogen and Oxygen to make Water. This equation looks like this:

_____ H_2 + _____ O_2 → _____ H_2O

Why do we write H_2 and O_2? (Hint: What is a diatomic element?)

What is the hint for remembering diatomic elements?

What are the masses of the elements/compounds in our model?
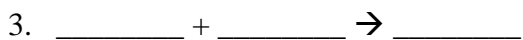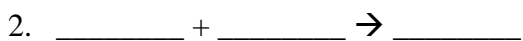 H_2:
 O_2:
 H_2O:

Try to balance the equation above. Now let's try modeling our ideas using the scale.

How did that work?

Are there any weaknesses with this model? What would you do to improve the model?

Let's try modeling other equations:

1. _____ + _____ → _____

2. _____ + _____ → _____

3. _____ + _____ → _____

4. _____ + _____ → _____

5. _____ + _____ → _____

<u>Analysis</u>

What have you learned about balancing equations after today's class?

Do you find it easier to picture balancing equations after seeing this model?

Do you think that you could use this model in math class? How?

Why is it so important for equations to be balanced?

What might happen if equations were NOT balanced?

CMST SCOLLARCITY **second tool** Lesson Plan using a second choice of modeling software**,** (Due Tuesday, August 10th).

Submit as hard copy AND electronically through ANGEL

Name:Tom McCarthy
Grade level(s)/Subject taught Geometry 10th Grade:
Objectives: (Remember…*How will the modeling tool help the student better learn the objective?)Math-Science concepts to be integrated: The concept in nature of symmetry* and duplication as in the hives of certain bees, the colonies of various ants or the formation of coral in the oceans. This will be compared with Tiling the Plane with the TI-84+. The class will begin with a brief review about selecting and drawing regular pentagons using the TI-84+ calculators. The team leaders of the different groups will demonstrate the necessary steps that will allow the groups to draw their original polygon that will be used to mimic nature. The group activity would last about 10 minutes(or less) followed by a short video depicting the symmetry seen in certain bee hives, ant nests and coral found in certain oceans and seas. He last stage will be for groups to each choose their own polygon to tessellate with the TI-84+ calculators.   Prompts: Using the TI-84+ calculators I plan on having my students mimic Nature by using tessellation(Tiling the Plane) on their calculators. The clas will begin with a brief review by the teacher of the way to draw regular polygons. After entering GeoMaster bu using the APPS,ALPHA,TAN keys they will push ENTER twice to bing up the MENU window and GRAPH, WINDOW 7 to bring RegPolygon to the screen. Pushing ENTER twice will anchor the center and pushing the > key once will bring up the fault #(6) and the + or – keys will allow the groups to choose their polygon according to the number of sides(3-12). By keeping x=0 and y= a small even # they

can keep their polygons at a small reasonable size which will keep more of the

tessellations on the view screen. Once the Group leaders have their team ready the

class will view Nature's attempts to show symmetry.

Items to include in your **second tool** lesson plan:

For the math teacher:
1. *Write* the Mathematical Concept or "key idea" that your second modeling tool will be used to teach: (e.g. Students use mathematical modeling/ multiple representation to provide a means of presenting, interpreting, communicating, and connecting mathematical information and relationships)

The key idea will be to use the TI-84+ calculators to mimic the symmetry of Nature by using the tessellation function to show Symmetry by Tiling the Plane.

and/or…

For the Science teacher:
1b. *Write* the Science Concept or "key idea" that your second modeling tool will be used to teach: (e.g. Organisms maintain a dynamic equilibrium that sustains life).

For you **second tool** lesson, please describe how you plan on using one of the remaining modeling software packages with your students (Stella, AS, GSP, or IP). You might describe what a visitor might see walking into your classroom during this lesson. You might also describe the role of the student during the entire lesson and your role as the teacher. Please try to be specific as possible. Also, construct a tentative rubric that you might use with your students. ** see example page 5 Thhe class will see a 10-15 minute video that exhibits the symmetry of Nature. The inside of beehives and insect tunnels or homes will be shown along with the growth of certain Pacific corals that tend to duplicate

their structures. The concept of exact duplication(no two snowflakes are exactly equal) can be mentioned but the main focus will will demonstrate how nature can reflect symmetry. Once the symmetry of Nature is observed the groups will reunite to learn the skill of Tiling the Plane.

Each group leader(having already been shown the necessary steps) will guide their group through the following steps. By pressing GRAPH, TRACE 5 the window will indicate that they are in the Symmetry window and by pressing ENTER the choice 1: Point 2 and 2: RegPolygon 0 will appear. By muving the v key once to the RegPolygon 0
Section and pressing ENTER twice the tessellation will take place and a duplicate of the polygon will appear at your chosen point. By using the ^, v, >, < keys the group will move to other points, press ENTER once bringing up the 1: Point   8 an 2: RegPolygon 0 they can move the v key to the RegPolygon 0, press ENTER twice and another tessellation will occur This can be repeated to mimic natures changes which show symmetry.

While the different groups are Tiling the Plane the teacher will observe each group, ask certain questions, but the groups and the Group Leaders will do almost all the work. An observer would see the use of the TI-84+ to integrate Mat-Scinc without notable

Input from the teacher. The Target students will be group leaders the Acceptable students will be able to draw regular polygons, and perform at least two tessellations. The Unacceptable level would be students who couldn't draw regular polygons and tessellate at least one figure. Hopefully the Unacceptable students will be few if any.