Lesson Title	Calculating the average mass of the newly discovered element: Bean (Bn)
Length of Lesson	90 minutes
Created By	Kelli Dawkins
Subject	Chemistry
Grade Level	10-12
State Standards	3b
DOK Level	2 , 3, and 4
DOK Application	Organize, separate, show, compare, and analyze
National Standards	A (inquiry) ;B(physical);G (history and nature of science)

Graduate Research Element

Student Learning Goal:
Chemistry- MS Science Framework 2010

3 Develop an understanding of the Periodic Table

b. Analyze patterns and trends in the organization of elements in the periodic table and compare their relationships to position in the periodic table. (DOK 2)

- **Average mass calculations**

National Science Education Standards of Content 9-12:

A- inquiry: use appropriate techniques to gather, analyze, and interpret data; think logically and critically to demonstrate connections between investigations of data and a historical body of knowledge.
B-matter is made of minute (unseen) particles of atoms; these components have measurable properties.
G-individuals and teams have contributed and will continue to contribute to the scientific enterprise; use logical arguments to gain the best explanations; be consistent with observational evidence and make accurate predictions about systems being studied.

Materials Needed (supplies, hand-outs, resources):
Bag of mixed beans (lima, kidney, and black), balance, worksheet, pencil, scientific calculator

Lesson Performance Task/Assessment:

Summative Assessment
Students will calculate the average mass of the element using the data they collect and calculate from the three isotopes.

Lesson Relevance to Performance Task and Students: The students will gain experience as to how the abundance of isotopes are calculated. This will enable them to then calculate the average mass of the element. This lesson and performance task will help increase a student's interest in chemistry by actually counting, weighing, and touching the element.

Anticipatory Set/Capture Interest: The students are told that the teacher discovered a new "element" overnight. The element is called Bean (Bn). It has a place on the periodic table but no information has been found to go in the square. The element is shown to have 3 isotopes – Lima, Kidney, and Black. They are all forms of the element: Bean.

Guided Practice:
The students are then shown examples of how to calculate abundance when given the number of individual isotopes found of a particular element.
The students are shown how to calculate the average mass of an element when given the abundance and mass of each isotope of the element.

Independent Practice:
Students are then instructed to count each type of the Bean element isotope to calculate abundance.
Students are then asked to weigh the 3 types of isotopes of the element Bean and calculate an "average" mass of each isotope.
From their data- the students will then be asked to calculate the average mass of the element BEAN (Bn) to write on an empty square on the periodic table.

Remediation and/or Enrichment:
Remediation: individual IEP; partner help throughout the less; shorten parts of the assignment; focus on each processes in single fashion.

Enrichment: Students can name several "isotopes" of different types of common items – i.e.: Shoes: tennis shoes, boots, and heels
Automobiles: car, truck, suv
Students can then create/design a method to calculate the average atomic mass of the element.

Check(s) for Understanding:
What are some elements that you are familiar with that have specific isotopes?
How are these isotopes important?
In what fields are these isotopes used most?

Closure:
After all laboratory data and calculations have been turned in, the new element is written on the periodic table hanging on the wall in the room. Later its placement will be discussed when the unit on the Periodic Table and periodic trends is introduced to the class.

Possible Alternate Subject Integrations:
Algebra
Biology – Carbon 14 dating

Teacher Notes:
Resource 10_22 bean isotope laboratory data sheet