PROTONS, NEUTRONS, ELECTRONS

NAME_____DATE_____PERIOD_____

SC.A.2.3.2.7.3 – determines the mass number and atomic number of an atom from the number of protons and neutrons
MA.A.3.3.3.7.1 – solves multi-step real-world problems involving whole numbers, fractions or decimals using appropriate methods of computation, such as mental computation, paper and pencil, and calculator

MATERIALS:

Periodic Table

BACKGROUND INFORMATION:

1. Element – atoms with the same number of protons are of the same element
2. Isotope – atoms of the same element with different numbers of neutrons are different isotopes of that element
3. Atomic Number = Number of Protons
4. Number of Protons = Number of Electrons
5. Atomic Mass – Number of Protons = Number of Neutrons

COMPLETE THE FOLLOWING CHART:

NOTE: Masses have been rounded to the nearest whole number.

ELEMENT	PROTONS	NEUTRONS	MASS	ELECTRONS
Hydrogen	1	0		
Nitrogen		7		7
Potassium		20	39	
Gold	79		197	

PROTONS, NEUTRONS, ELECTRONS
Page 2

ISOTOPE OR DIFFERENT ATOM:

Determine if the following atoms are isotopes or different atoms.

1. Atom A has 8 protons and 9 neutrons.
   Atom D has 8 protons and 10 neutrons. _____

2. Atom E has 10 protons and 9 neutrons.
   Atom G has 12 protons and 9 neutrons. _____

3. Atom J has an atomic number of 4 and 6 neutrons.
   Atom L has 4 protons and 9 neutrons. _____

PROTONS, NEUTRONS, ELECTRONS

NAME **TEACHER COPY** DATE_____PERIOD_____

SC.A.2.3.2.7.3 – determines the mass number and atomic number of an atom from the number of protons and neutrons
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COMPLETE THE FOLLOWING CHART:
NOTE: Masses have been rounded to the nearest whole number.

ELEMENT	PROTONS	NEUTRONS	MASS	ELECTRONS
Hydrogen	1	0	**1**	**1**
Nitrogen	**7**	7	**14**	7
Potassium	**19**	20	39	**19**
Gold	79	**118**	197	**79**

PROTONS, NEUTRONS, ELECTRONS—Teacher Copy Page 2

ISOTOPE OR DIFFERENT ATOM:

Determine if the following atoms are isotopes or different atoms.

1. Atom A has 8 protons and 9 neutrons.
   Atom D has 8 protons and 10 neutrons. **ISOTOPE**

2. Atom E has 10 protons and 9 neutrons.
   Atom G has 12 protons and 9 neutrons. **DIFFERENT**

3. Atom J has an atomic number of 4 and 6 neutrons.
   Atom L has 4 protons and 9 neutrons. **ISOTOPE**

ATOMS—KWL CHART

NAME_____DATE_____PERIOD_____

SC.A.2.3.2.7.3 – determines the mass number and atomic number of an atom from the number of protons and neutrons

K What do you **KNOW**?	**W** What do you **WANT** to know?	**L** What did you **LEARN**?
1. From the periodic table – what number equals the number of protons?		
2. From the periodic table – how is the mass of a "regular" atom determined?		
3. Define isotope.		
4. Why are the masses on the periodic table decimal numbers?		

ATOMS—KWL CHART

NAME **TEACHER COPY** DATE_____PERIOD_____

SC.A.2.3.2.7.3 – determines the mass number and atomic number of an atom from the number of protons and neutrons

K What do you **KNOW**?	**W** What do you **WANT** to know?	**L** What did you **LEARN**?
1. From the periodic table – what number equals the number of protons?		
ATOMIC NUMBER		
2. From the periodic table – how is the mass of a "regular" atom determined?		
PROTONS+ NEUTRONS = **ATOMIC MASS**		
3. Define isotope.		
ATOM OF AN ELEMENT THAT HAS THE SAME NUMBER OF PROTONS AS ANOTHER ATOM OF THE SAME ELEMENT BUT A DIFFERENT NUMBER OF NEUTRONS.		
4. Why are the masses on the periodic table decimal numbers?		
AVERAGE OF ALL THE ISOTOPES OF THAT ELEMENT		

ISOTOPES RUBRIC

NAME_____DATE_____PERIOD_____

SC.A.2.3.2.7.3 – determines the mass number and atomic number of an atom from the number of protons and neutrons
SC.H.3.3.1.7.2 – uses appropriate procedures for safety in the classroom, home and community
MA.B.4.3.2.7.2 – measures accurately with the measurement tools to the specified degree of accuracy for the task and in keeping with the precision of the measurement tool

Category	4	3	2	1
ATOMIC NUMBER	Identifies the atomic number as being the same number as the number of protons.			With help identifies the atomic number as being the same number as the number of protons.
MASS NUMBER	Identifies the mass number as being the number protons + the number of neutrons.			With help identifies the mass number as being the number protons + the number of neutrons.
USE OF LAB EQUIPMENT	Lab equipment used with little or no direction from teacher.	Lab equipment used effectively with some extra direction from teacher.	Lab equipment used effectively, but with guidance from teacher.	Struggles with directions for using lab equipment.
LAB SAFETY	All safety rules in the lab are followed.			One or more safety rules are not followed.
MEASUREMENT	Measurements made with little or no direction from teacher.	Measurements made with some extra direction from teacher.	Measurements made effectively, but with guidance from teacher.	Struggles with directions for completing measurements.
GOAL 3: #3	The student accurately uses numeric operations to complete mass averages.			The student shows minimal accuracy in the use of numeric operations and is unable to complete the mass averages.
GOAL 3: #8	The student completes all tasks and works/communicates effectively with other class members.	The student completes most important tasks and works/communicates effectively with other class members.	The student completes some of the important tasks and works/communicates effectively with other class members.	The student shows minimal understanding of the tasks and is unable to work/communicate effectively with other class members.

ISOTOPES MODEL LAB

NAME_____DATE_____PERIOD_____

SC.H.3.3.1.7.2 – uses appropriate procedures for safety in the classroom, home and community
MA.B.4.3.2.7.2 – measures accurately with the measurement tools to the specified degree of accuracy for the task and in keeping with the precision of the measurement tool
MA.A.3.3.3.7.1 – solves multi-step real-world problems involving whole numbers, fractions or decimals using appropriate methods of computation, such as mental computation, paper and pencil, and calculator

OBJECTIVE:
To construct an isotope model.

MATERIALS:
- 60 dry lima beans (20 small, 20 medium, 20 large)
- sandwich-size Ziploc bag
- balance (triple beam or electronic)

PROCEDURE:
1. Count out 50 whole lima beans from the Ziploc bag. Place the others back in the bag.
2. Place the 50 lima beans on the platform of the balance and determine the mass to the nearest tenth of a gram.
3. Record this mass on your Data Chart. (See below)
4. Now find the average mass of these 50 lima beans and record on the Data Chart. Average mass = mass of beans divided by number of beans.
5. Remove the 50 lima beans from the platform and divide into three piles. Small, medium, large.
6. Select one small bean and place on the platform of the balance. Determine the mass and record on the Data Chart.
7. Repeat procedure #6 with a medium size bean and then a large bean.
8. Answer Questions # 1 - 3.
9. Look at the three piles of beans and the individual masses for each size bean. Now answer Question #4.
10. Place all the lima beans in the Ziploc bag and clean up.

DATA CHART:
50 Beans TOTAL MASS = _____ AVG. MASS = _____

1 small bean MASS = _____

1 medium bean MASS = _____

1 large bean MASS = _____

ISOTOPES MODEL LAB
Page 2

QUESTIONS:

Questions 1 – 3 circle the correct answer.

1. How does the mass of the smaller bean compare with the average mass of the 50 beans?
EQUAL TO LARGER THAN SMALLER THAN

2. How does the mass of the medium bean compare with the average mass of the 50 beans?
EQUAL TO LARGER THAN SMALLER THAN

3. How does the mass of the larger bean compare with the average mass of the 50 beans?
EQUAL TO LARGER THAN SMALLER THAN

4. How are the lima beans in this experiment like the isotopes of an element?

ISOTOPES MODEL LAB—Teacher Copy
Page 2

QUESTIONS:

Questions 1 – 3 circle the correct answer. **ANSWERS TO #2 CAN VARY.**

1. How does the mass of the smaller bean compare with the average mass of the 50 beans?
EQUAL TO LARGER THAN **SMALLER THAN**

2. How does the mass of the medium bean compare with the average mass of the 50 beans?
EQUAL TO LARGER THAN SMALLER THAN

3. How does the mass of the larger bean compare with the average mass of the 50 beans?
EQUAL TO **LARGER THAN** SMALLER THAN

4. How are the lima beans in this experiment like the isotopes of an element?

The size and mass vary but they are still lima beans. (Isotopes of an element will vary in size and mass, but will still be called by that element name.)