_____ _____

_____ _____

ISOTOPES LAB

The atomic mass of an element is determined by the number of protons and neutrons in the nucleus. If you look at a periodic table of the elements, however, you will notice that the atomic masses of the elements are not written as whole numbers. All of the atoms of a given element have the same number of protons in their nuclei, but the number of neutrons can be different. Atoms of the same element with different numbers of neutrons are called *isotopes*. As shown in the periodic table, the atomic mass for an element is a weighted average of the masses of all its isotopes.

In this activity, you will make models of the atomic nuclei of isotopes of the same element. Each nucleus will be represented by a plastic cup, protons will be represented by black beans, and neutrons will be represented by white beans. You will use the mass numbers of your atomic models to find the weighted average atomic mass for the element.

MATERIALS

- 10 small plastic cups (atoms)
- 1 cup of black beans (protons)
- 1 cup of white beans (neutrons)
- calculator
- periodic table

PROCEDURE

ELEMENT A

1. Put 5 black beans in each of the cups. Add 5 white beans to 2 of the cups. Add 6 white beans to each of the remaining cups.
2. Determine the actual element represented by Element A. In Data Table A, record the name (e.g. Oxygen-16), number of atoms, and mass number for each of the two isotopes you created.

ELEMENT B

3. Empty the cups. Put 12 black beans in each of the cups. Add 12 white beans to 8 of the cups. Add 13 white beans to one of the remaining cups and 14 beans to the last cup.
4. Determine the actual element represented by Element B. In Data Table B, record the name, number of atoms, and mass number for each of the three isotopes you created.

DATA

DATA TABLE A

NAME	# OF ATOMS	MASS #

DATA TABLE B

NAME	# OF ATOMS	MASS #

ANALYSIS

Calculate the average atomic mass for each element. Show your calculations and include units.

CALCULATIONS	AVERAGE ATOMIC MASS

CONCLUSIONS

List the average atomic mass for each element as it appears on the periodic table. How well do your calculated values agree with these accepted values?

How did you determine which elements were being represented? How did you determine the mass numbers of the isotopes? Explain in terms of beans and what they represent.

1. What is an isotope? _____

_____

2. What does the number next to isotopes signify? _____

_____

3. How can you tell isotopes apart? _____

_____

For each of the following isotopes, write the number of protons, neutrons, and electrons.

	Chromium-58	Chromium-63
# of protons		
# of neutrons		
# of electrons		

	Carbon-12	Carbon-16
# of protons		
# of neutrons		
# of electrons		

	Nitrogen-15	Nitrogen-20
# of protons		
# of neutrons		
# of electrons		

	Sulfur-23	Sulfur-25
# of protons		
# of neutrons		
# of electrons		

	Sodium-12	Sodium-20
# of protons		
# of neutrons		
# of electrons		

	Selenium-30	Selenium-35
# of protons		
# of neutrons		
# of electrons		

PARTS OF AN ATOM

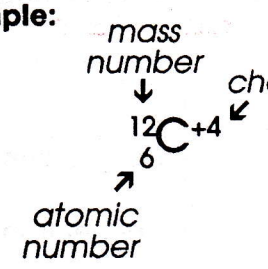
An atom is made up of protons and neutrons which are in the nucleus, and electrons which are in the electron cloud surrounding the atom.

The atomic number equals the number of protons. The electrons in a neutral atom equal the number of protons. The mass number equals the sum of the protons and neutrons.

The charge indicates the number of electrons that have been lost or gained. A positive charge indicates the number of electrons (which are negatively charged) lost. A negative charge indicates the number of electrons gained.

This structure can be written as part of a chemical symbol.

Example:



This carbon ion would have 6 protons, 6 neutrons and 2 electrons.

Complete the following chart.

Element/ Ion	Atomic Number	Mass Number	Charge	Protons	Neutrons	Electrons
$^{24}_{12}Mg$						
$^{39}_{19}K$						
$^{23}_{11}Na^{+1}$						
$^{19}_{9}F^{-1}$						
$^{27}_{13}Al^{+3}$						
$^{1}_{1}H$						
$^{24}Mg^{2+}$						
Ag						
S^{-2}						
$^{2}_{1}H$						
$^{35}Cl^{-}$						
Be^{2+}						