Chapter 3:
Average Atomic Mass

Calculate the students average

- Change % □ decimal
- Grade X decimal =
- ADD

Category	Grade	Weight (%)
Test	85 x .50 = **42.5**	
Quiz/lab	92 x .40 = **36.8**	
HW	95 x .10 = **9.5**	

\+

88.8

Or

89

Average Atomic mass is the **weighted average** of all the naturally occurring isotopes of that element.

$$\left[\begin{array}{c}\text{Mass Isotope}\\ \#1\end{array}\right]\left[\begin{array}{c}\text{Relative}\\ \text{Abundance \#1}\end{array}\right] + \left[\begin{array}{c}\text{Mass Isotope}\\ \#2\end{array}\right]\left[\begin{array}{c}\text{Relative}\\ \text{Abundance \#2}\end{array}\right] + \ \ldots\ = \begin{array}{c}\text{Average Atomic}\\ \text{Mass}\end{array}$$

Check answer on the Periodic Table

Round to 2 decimal places

$$\left(\begin{array}{c}\boldsymbol{Relative}\\ \boldsymbol{Abundance}\end{array}\right) = \frac{\%}{100} \qquad \boldsymbol{Unit}: \frac{\boldsymbol{g}}{\boldsymbol{mole}} \ \textbf{or amu}$$

- When you add % what value is produced? **100**
- When you add Relative Abundances what value is produced? **1**

Chlorine-35 is one isotope of chlorine. (35 is the mass number). Chlorine-37 is another isotope of chlorine. How many protons and how many neutrons are in each isotope of chlorine?

Isotope	Protons	Neutrons
Chlorine-35	**17**	**18**
Chlorine-37	**17**	**20**

Of all chlorine atoms, 75.771% of chlorine atoms have a mass of 34.96885 amu. All other chlorine atoms are chlorine-37 and these have a mass of 36.96590 amu. What is the average atomic mass of chlorine?

Isotope Mass (amu)	Weight (%)
34.96885	75.771
36.96590	24.229

$34.96885 \times .75.771 = 26.4962$

$36.96590 \times .24.229 = +8.956$

$35.45 \frac{g}{mole}$

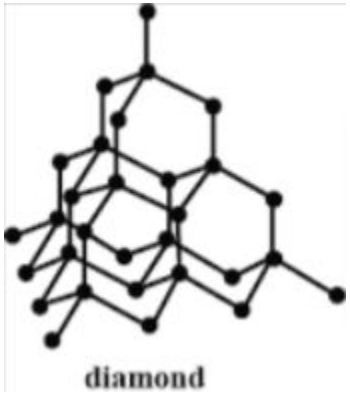
- Change % □ decimal
- Grade X decimal =
- ADD

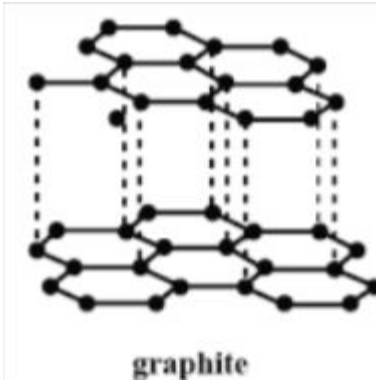
Neon has 3-different isotopes. 90.51% of neon atoms have a mass of 19.992 amu. 0.27% of neon atoms have a mass of 20.994 amu. 9.22% of neon atoms have a mass of 21.991 amu. What is the average atomic mass of neon?

Isotope Mass (amu)	Weight (%)	
19.992	X .90.51	= 18.095
20.994	X .00.27	= 0.0567
21.991	X .09.22	= 2.0276
		+
		20.18 $\frac{g}{mole}$

- Change % □ decimal
- Grade X decimal =
- ADD

Isotope Vs. Allotrope

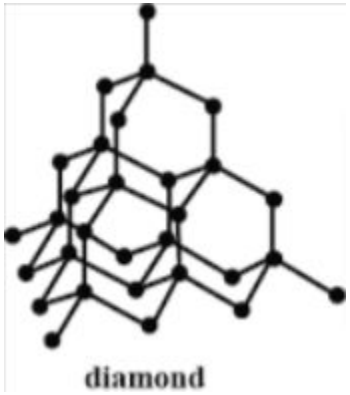


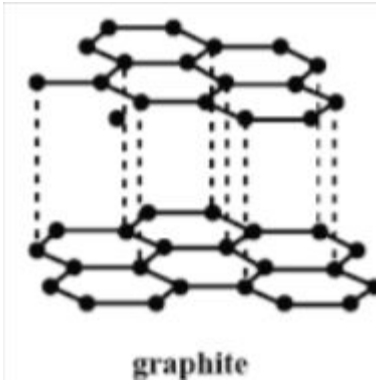


<u>Isotope Composition</u> SAME

99.89% Carbon-12 & 1.11% Carbon-13

Isotope Vs. Allotrope





Colorless
Very Hard
Insulator

Properties

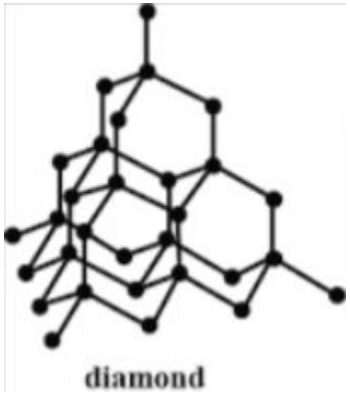
Black
Soft
Conductor

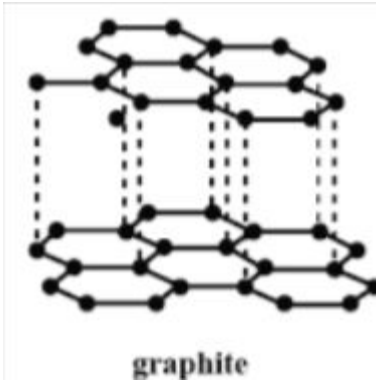
Can the existence of 2 isotopes explain the difference in the properties?

NO

SAME Composition: 99.89% C-12 & 1.11% C-13
DIFFERENT Properties

Isotope Vs. Allotrope





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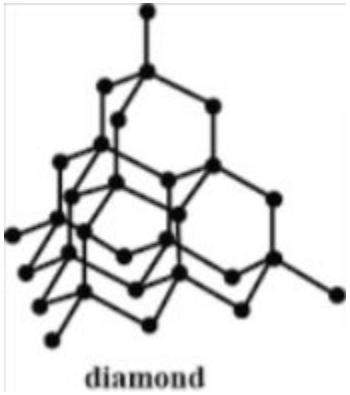
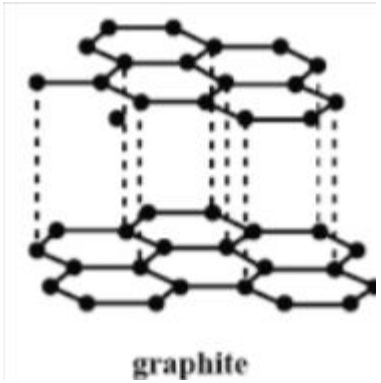
Propose an explanation for the differences of properties of diamond & graphite:

Diamond: 3-D structure & Graphite: Flat sheets

Different structures (ways of bonding) leads to different properties

Isotope Vs. Allotrope





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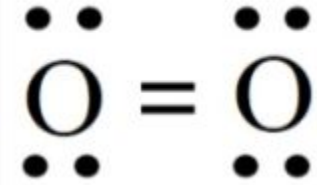
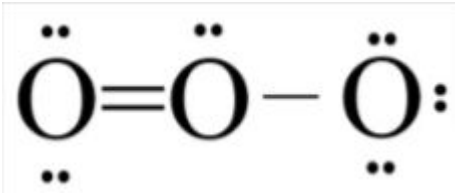
Define ALLOTROPE

Samples of the same element that have different properties b/c of bonding and structure differences

Allotropes of Oxygen

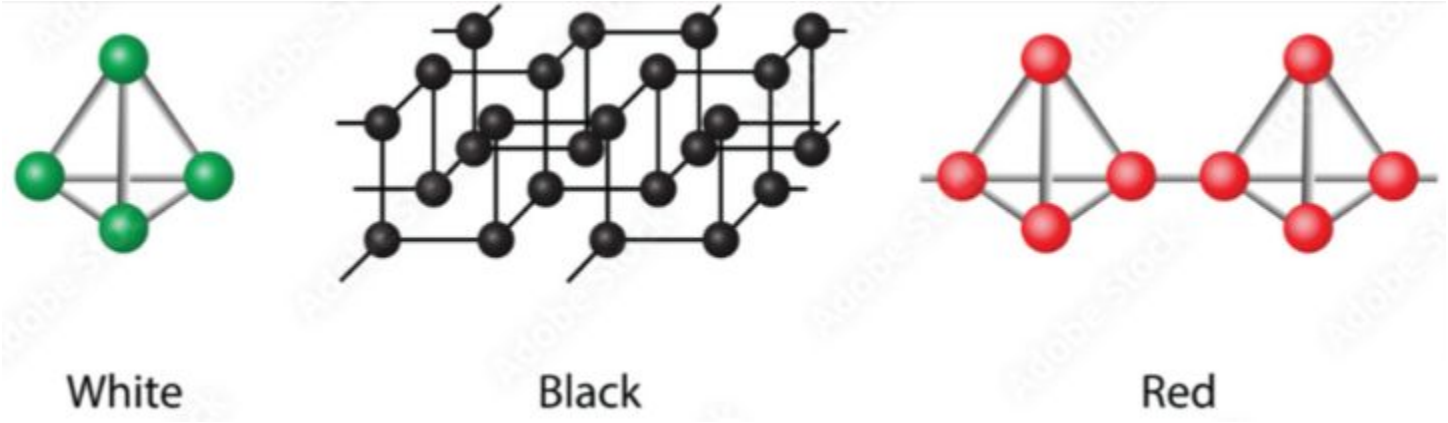


Oxygen
(what we breath)



Ozone
(in the atmosphere)

Allotropes of Phosphorus



Gallium has 2-naturally occurring isotopes, ^{69}Ga and ^{71}Ga with masses of 68.9257 amu and 70.9249 amu, respectively. Calculate the % abundance of these isotopes of gallium?

$$(68.9257)X + (70.9249)(1-X) = 69.723$$

Off P.T.

Isotope	Mass (amu)	% Ab.	Rel. Ab.
Ga-69	68.9257	X	X
Ga-71	70.9249	Y	Y = (1-X)

$X+Y=100$ $X+Y=1$

(68.9257) X + (70.9249)(1-X) = 69.723

Solve for "X"

X = .6012 x 100= 60.1% Ga-69

Rel. Ab. 39.9% Ga-71
Ga-69