John Dalton proposed that ________________ is made up of ____________________
The particles are ____________________ or ____________________
___________________________ can be broken down into __________________ by chemical
processes.
________________ cannot be __________________________ by ____________________ or
______________________ processes.

A Summary of Dalton’s Atomic Theory:

1) An element is composed of __________________________________________ particles called atoms.
2) All atoms of an element are ____________________________________________.
3) Atoms of __________________ elements combine to form ____________________.
4) Compounds contain atoms in ____________________________________________.
5) Atoms can combine __________________________ to form different compounds.

The first 2 parts of Dalton’s theory were later proven incorrect:

INDIVISIBLE: Two ________________ particles were discovered.

1) __________________ charged ________________, _____ (relative charge of _____)
2) __________________ charged__________________, _____(relative charge of _____)

INDESTRUCTIBLE: Nuclear reactions were later discovered where ________________ of
atoms occurred.

IDENTICAL: ________________ were discovered, where atoms of the______________
element had ________________ masses.
Slide 7  Mass of Subatomic Particles

Mass of electron:

Mass of proton:

NOTE: The proton is ________________times heavier than the electron.

Slide 8  Types of Radiation

Three types of radiation:

1) Alpha (   ) particles are composed of

2) Beta (    ) particles are composed of

3) Gamma (   ) rays are

Slide 9  Rutherford’s Gold Foil Experiment

Rutherford fired α-particles at ______________________________________. If the “plum pudding” model was correct, they should pass through _______________________________.

Most alpha particles _______________________________________________.

Some alpha particles were ____________________________________________.

A few alpha particles were ____________________________________________.

Slide 10  Explanation of Scattering

Most of the alpha particles ______________ through the _______ because an atom is mostly
_________________  _______________________.

Some alpha particles were ________________________at small angles because the _____ helium nucleus encountered a ______________________ in the atom. Rutherford proposed that at the center of the atom is the __________________ which contains the atom’s ______________________.
The alpha particles that bounced _____________________ did so after striking the ________________ nucleus.

Slide 11  Rutherford’s Model of the Atom

Rutherford proposed a new model of the atom:

The ____________charged ___________________ are distributed around a ________________ charged ___________________ (containing protons and neutrons).

Slide 12  Subatomic Particles Revisited

Based on the ________________ of the nucleus, Rutherford predicted that it must contain ________________ particles in addition to ________________.

____________________________ were discovered about ________ years later. A neutron has the same ________________ of a proton, but is ________________.

<table>
<thead>
<tr>
<th>Table 5.1 Subatomic Particles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subatomic Particle</td>
</tr>
<tr>
<td>electron</td>
</tr>
<tr>
<td>proton</td>
</tr>
<tr>
<td>neutron</td>
</tr>
</tbody>
</table>

Mass is expressed in “amu”, ____________________________, when small particles are concerned.

6.02 x 10²³ amu = 1 g  OR  1 amu = ________________ g
• Each element has a unique number of ____________ in the nucleus. This is the ________________.
• The total number of __________________________ in the nucleus of an atom is ________________.
• We use ___________________________ to display the number of protons and neutrons in the nucleus of an atom:

Slide 14 Using Atomic Notation or Nuclear Symbol

• An example:
  • The element is ________________________________.
  • The atomic number is ____________________________________________________.
  • The mass number is _______ – the atom of ________________________________________.
  • The number is neutrons is: ____________________________________________________.

Slide 15 Isotopes

• All atoms of the __________________ have the same number of ________________.
• Most elements occur naturally with ________________________________________________.
• Atoms of the _____________________ that have a ______________________ number of ________________ in the nucleus are called ____________________.
• Isotopes have the same __________________________ but different ________________ numbers.

Slide 16 Isotopes of Hydrogen

protium deuterium tritium

What is the same?
What is different?

Slide 17 Isotopes Continued

• We often refer to an isotope by stating the ____________ of the element followed by the ____________ number.
  – Cobalt-60 is ____________
  – Carbon-14 is ____________
• How many protons and neutrons does an atom of mercury-202 have?
Practice: Complete the table

<table>
<thead>
<tr>
<th>Isotope Name</th>
<th>Isotope Symbol</th>
<th>Atomic No</th>
<th>Mass No</th>
<th># p+</th>
<th># n°</th>
<th># e-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neon-22</td>
<td>¹²⁹I</td>
<td>53</td>
<td>74</td>
<td>108</td>
<td>28</td>
<td>14</td>
</tr>
</tbody>
</table>

Simple & Weighted Averages

- A simple average assumes ________________________________________________.
- A weighted average takes into account the fact that we do not have ________________________________________________.
- A weighted average is calculated by multiplying ____________________________________ (as a decimal number) by its __________________________________________ and adding the numbers together.

Average Atomic Mass

- Since not all isotopes of an atom are present in ____________________________________, we must use the ________________________________________.

- Copper has two isotopes:
  - ⁶³Cu with a mass of 62.930 amu and 69.09% abundance
  - ⁶⁵Cu with a mass of 64.928 amu and 30.91% abundance
- The average atomic mass of copper is:

Periodic Table

- We can use the periodic table to obtain the ___________________________ and ___________________________ of an element.
- The periodic table shows the ____________________, ____________________, and ____________________ for each element.

Wave Nature of Light

- Light travels through space as a _______________ similar to an _______________.
- Wavelength is the _______________ light travels in _______________.
- Frequency is the number of _______________ completed each _______________.
- Light has a _______________ speed: ____________________.
Light usually refers to radiant energy that is visible to the human eye. The **visible spectrum** is the range of ________________________________. Radiant energy that has a wavelength lower than 400 nm and greater than 700 nm _______________________________________________________________________.

The complete **radiant energy spectrum** is an_______________________________________, or ___________________________________.

In 1900, Max Planck proposed that radiant energy is not ______________________, but is emitted in ________________________. This is the _______________________. Radiant energy has **both** a _____________ nature and a _________________ nature.

An individual unit of light energy is a __________________________.

The _______________ concept states that ________________________ is present in _______________________________ bundles.

For example:
- A tennis ball that rolls down a _________________ loses potential energy _________________.

PDF created with FinePrint pdfFactory trial version [http://www.pdffactory.com](http://www.pdffactory.com)
– A tennis ball that rolls down a ____________________ loses potential energy in ______________________. The loss is ____________________.

Slide 34  Bohr Model of the Atom

• Niels Bohr speculated that electrons orbit about the nucleus in ________________________.
• Electrons are found only in ________________________________, and nowhere else.
• The ____________________________ are quantized.
• “Orbits” or “Energy Levels” are designated ____________________________ etc.

Slide 35  Emission Line Spectra

• When an __________________________ is passed across a gas in a sealed tube, a series of ____________________________ is seen.
• These lines are the _____________________________. The emission line spectrum for ____________________________ shows three lines: 434 nm, 486 nm, and 656 nm.

Slide 36  Evidence for Energy Levels

The electric charge temporarily __________________ an electron to a __________________________.
When the electron ________________________________, a photon is given off.

The wavelength of the ____________________________ corresponds to the ________________ released when the electron drops from ________________________________.

Slide 37  “Atomic Fingerprints”

The _________________________________ of each element is ______________________.

We can use the ______________________________ for the __________________________ of elements, using their ________________________________.

See Fig 15.14 A Continuous Spectrum versus Line Spectra
Slide 38-39  Energy Levels and Sublevels

Electrons occupy ________________________________ within each E level.

Sublevel designations: _____, _____, ______, and ______

The number of sublevels in each E level is the same as the n value of the E level.

The first E level (_____ ) has _____ sublevel:
The second E level (_____ ) has _____ sublevels:
The third E level (_____ ) has _____ sublevels:
The fourth E level (_____ ) has _____ sublevels:
The fifth E level (_____ ) has _____ sublevels:

In reality, the highest sublevel to be filled with electrons is the ______. The sublevels beyond that remain unfilled.

Slide 40  Quantum Mechanical Model

An orbital is the ________________________________ where there is a high probability of finding an ________________.

In the quantum mechanical atom, orbitals are ________________________________

The higher the ____________________ of an orbital, the _______________________ its size.

Slide 41  Shapes and Orientations of s-Orbitals

S-orbitals have a ______________________ shape. There is ______ orientation for s-orbitals.

Slide 42  Shapes and Orientation of p-Orbitals

p-orbitals have a ______________________ shape. There are _____ orientations for p-orbitals.

Slide 43  Shapes and Orientation of d- and f-orbitals

d-orbitals have a ______________________ shape. There are _____ orientations for d-orbitals.

f-orbitals have a ______________________ shape. There are _____ orientations for f-orbitals.
The _______________________ number of electrons per _____________________________ is _____.

The ____ orbital holds a maximum of _____ electrons (______________________________)
The ____ orbital holds a maximum of _____ electrons (______________________________)
The ____ orbital holds a maximum of _____ electrons (______________________________)
The ____ orbital holds a maximum of _____ electrons (______________________________)

<table>
<thead>
<tr>
<th>Energy Level</th>
<th>Energy Sublevel</th>
<th>Max e⁻ in Sublevel</th>
<th>Max e⁻ in Energy Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1s</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2s</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2p</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>3s</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3p</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3d</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>4s</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4p</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4d</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4f</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Slide 45  Electrons per Energy Level

Slide 46-47  Filling Diagram for Sublevels & Electron configurations

Slide 48  Using the Periodic Table

Slide 49  Electron configurations
The **electron configuration** of an atom is a shorthand method of _________________________

The sublevel is written followed by a superscript with the number of electrons in the sublevel.
- If the $2p$ sublevel contains _____________________, it is written ______________

The electron sublevels are arranged according to ________________________________.

<table>
<thead>
<tr>
<th></th>
<th>Complete</th>
<th>Shorthand</th>
</tr>
</thead>
<tbody>
<tr>
<td>He</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>O</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Na</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ar</td>
<td></td>
<td></td>
</tr>
<tr>
<td>K</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Slide 52   Writing Electron Configurations (More Practice)