Note Taking Guide: Episode 301

Model: A __________ idea used to explain __________ facts __________ in __________.

Theory: An __________ of __________ facts and __________.

To remain valid, models and theories must:
• __________ all known __________
• enable __________ to make correct __________

Democritus:
• proposed the __________ of an __________
• word comes from the __________ word __________ which means __________ __________ __________ or “indivisible”

Aristotle
• __________ the __________ of the __________
• said __________ could be __________

Dalton’s theory proposed that atoms:
• are __________ __________ of __________
• are __________
• of the __________ __________ are __________

J.J. Thomson
• credited with __________ of _________: a blow to _________ _________ atom
• proposed the __________ _________ model of the _________:
_______ charged __________
embedded in a ball of _________ _________

Rutherford’s Gold-foil Experiment:
• aimed _________ _________ at _________ _________
• _________ passed _________
• a _________ particles were _________
• _________ particles even _________ _________

Conclusions of Rutherford's experiment:
• _________ of the _________ is _________ _________
• _________ _________ charged _________
The Chemistry Quiz

CR1. _____ CR2. _____ 1. _____ 2. _____
3. _____ 4. _____ 5. _____

The Atoms Family
Atomic Math Challenge

**Oxygen**
- Atomic number equals the number of _____
or _____
- Atomic mass equals the number of _____ + _____

**Zinc**
- Atomic number equals _____
- Atomic Mass = _____
- # of Protons = _____
- # of Neutrons = _____
- # of Electrons = ______

**Li**
- Atomic number equals _____
- Atomic Mass = _____
- # of Protons = _____
- # of Neutrons = _____
- # of Electrons = ______

**Gold**
- Atomic number equals _____
- Atomic Mass = _____
- # of Protons = _____
- # of Neutrons = _____
- # of Electrons = ______

**H**
- Atomic number equals _____
- Atomic Mass = _____
- # of Protons = _____
- # of Neutrons = _____
- # of Electrons = ______

**Fluorine**
- Atomic number equals _____
- Atomic Mass = _____
- # of Protons = _____
- # of Neutrons = _____
- # of Electrons = ______

Name ___________________________
Use the information provided in notes and your textbook to answer the following questions.

Critical Thinking Questions

1. How many protons are found in each of the following: \(^1\text{H}\) in \(^2\text{H}\) in \(^3\text{H}\)?

2. How many neutrons are found in each of the following: \(^1\text{H}\) in \(^2\text{H}\) in \(^3\text{H}\)?

3. How many electrons are found in each of the following: \(^1\text{H}\) in \(^2\text{H}\) in \(^3\text{H}\)?

4. What structural characteristics do all hydrogen atoms have in common?

5. What structural characteristics do all carbon atoms have in common?

6. What does the mass number tell you? Can you find the mass number of an element on the periodic table?

7. What does the atomic number tell you? Can you find the atomic number of an element on the periodic table?

8. Define the term isotope.

9. How does one isotope of carbon differ from another isotope of carbon?

11. In atomic mass units (amu), what is the mass of an electron?

12. Is most of the mass of an atom located in the nucleus or outside the nucleus? How do you know?

13. If protons and neutrons have the same mass, what is the approximate mass of a proton and neutron in atomic mass units (amu)?
STRUCTURE OF an Atom (An Atom with no Charge)

Draw and Label the parts of the atom that make up the following Elements:

FILL IN the Box Symbol, Atomic No., Mass No.; # of Protons, Neutrons and Electrons

The symbol is \( \chapter{X} \), where \( A \)=mass#, \( Z \)=Atomic#, \( C \)=charge, \( X \)=Element Symbol

Ex: COLOR Protons, Neutrons, and Electrons. Include a legend of colors used for each

DRAW the correct number of Proton(s), Neutron(s), and Electron(s)

WORK CAREFULLY - NEATNESS COUNTS TOWARD YOUR GRADE

Hydrogen

Symbol

Atomic No. = 
Mass No. = 
___ Protons
___ Neutrons
___ Electrons

Helium

Symbol

Atomic No. = 
Mass No. = 
___ Protons
___ Neutrons
___ Electrons

Beryllium

Symbol

Atomic No. = 
Mass No. = 
___ Protons
___ Neutrons
___ Electrons

Carbon

Symbol

Atomic No. = 
Mass No. = 
___ Protons
___ Neutrons
___ Electrons

Sodium

Symbol

Atomic No. = 
Mass No. = 
___ Protons
___ Neutrons
___ Electrons

Chlorine

Symbol

Atomic No. = 
Mass No. = 
___ Protons
___ Neutrons
___ Electrons
Directions: Find the right word from the physics vocabulary list that completes the following sentences.

1. A traveling disturbance of energy is called a ____________.
2. The number of wave cycles in a unit of time is called the wave ____________.
3. A ____________ is an intervening substance that allows energy to pass.
4. The energy of sound, explosions, and earthquakes are all propagated by ____________ waves.
5. Electromagnetism is propagated by ____________ waves.
6. The density of the medium is called its ____________.
7. ____________ are sub-atomic particles of energy and matter propagated by electromagnetic waves.
8. Waves that change direction when they bounce off a barrier are ____________ waves.
9. In music, the frequency of the sound waves determine its ____________.
10. The theory that electromagnetism is made up of both energy and sub-atomic particles is called the ____________.

Word Match

Directions: Connect the word with the proper definition.

- amplitude: speed of the wave
- elasticity: determined by the frequency of the sound waves
- frequency: density of the medium
- longitudinal: height of the wave
- medium: distance of one complete wave cycle
- pitch: waves that travel up and down
- transverse: disturbance of energy
- velocity: waves created by the movement of molecules
- wave: wave cycles in a given unit of time
- wavelength: allows energy to pass through
Electrons and Radiation: Waves or Particles?

Instructions: Using the websites and the PowerPoints provided, answer the questions below.
Key in the URL: http://webs.morningside.edu/slaven/Physics/uncertainty/uncertainty3.html

1. What is the title of this page? ________________________________________________________

2. What question did De Broglie ask about electrons?
__________________________________________________________________________________
__________________________________________________________________________________
__________________________________________________________________________________

3. What ‘particles’ do you think we will further investigate in this web quest?
__________________________________________________________________________________


Define and explain what a mechanical wave is:
__________________________________________________________________________________

Click on the link: http://s3.amazonaws.com/scschoolfiles/237/2014-2015waves_and_particlespptch04.pdf, Click through the POWERPOINT to answer the questions below:

1. Wavelength: ______________________________________________________________________

2. Frequency: ______________________________________________________________________

3. Amplitude: ______________________________________________________________________

4. Draw a transverse wave, label the trough, crest, amplitude, and wavelength.

Click on the link: http://s3.amazonaws.com/scschoolfiles/237/2014-2015characteristics_of_waves.pdf, click through the power point and answer the questions below.

1. Define Medium: __________________________________________________________________

2. What type of wave does not need a medium? __________________________________________

3. What unit is used to label frequency? _______________________________________________
4. If a wave has a high frequency, will it have a short or long wavelength? _____________________________

5. What type of wave did you draw above? _____________________________

Click on the link: http://s3.amazonaws.com/scschoolfiles/237/2014-2015waves_and_particlespptch04.pdf Click through the POWERPOINT and answer the questions below:

6. What scientist discovered that light exhibited the behavior of both a particle and a wave? ____________________________________________________________________________________

7. What is this behavior called? ____________________________________________________________________________________

Key in the URI: http://www.physics4kids.com/files/light_intro.html and answer the questions below:

1. What is another name scientist’s call light: ____________________________________________________________________________________?

2. Is visible light the only kind of EMR? ____________.

3. The key thing to remember is that light and EM radiation carry ____________________________________________.

4. The quantum theory states: ____________________________________________________________________________________

5. Small particles of energy are called: ____________________________________________________________________________________.

6. Click on the link: visible light. Finish this statement, Visible light is the ____________________________________________________________________________________.

7. What colors can we seen in the visible light spectrum? ____________________________________________

8. What is an easy way to remember these colors? ____________________________________________

Click on the link: http://s3.amazonaws.com/scschoolfiles/237/2014-2015waves_and_particlespptch04.pdf Click through the POWERPOINT and answer the questions below.

1. Define Electromagnetic Radiation: ____________________________________________________________________________________.

2. Define Photon: ____________________________________________________________________________________.

3. List all types of electromagnetic radiation found on the spectrum: ____________________________________________________________________________________

Key in the URL: http://www.chemguide.co.uk/inorganic/group1/flametests.html, scroll down to the sub-heading The origin of flame colors, read this portion of the web site and answer the questions below.

1. What produces the flame colors in a flame test? ____________________________________________________________________________________

2. What happens then an electron gains energy? ____________________________________________________________________________________

3. When an electron jumps back to its original sublevel, what does it emit? ____________________________________________________________________________________

4. What causes the different colors of light to be seen in the flame test? ____________________________________________________________________________________
Orbitals Handout

Electrons are found in orbitals that surround the nuclei of atoms. The four types of ground state orbitals include s-orbitals, p-orbitals, d-orbitals, and f-orbitals. In each energy level, s-orbitals have the least energy, followed by p-orbitals, d-orbitals, and f-orbitals.

When energy is added to an atom in the form of light, heat, or electricity, the electrons absorb this energy and use it to jump to higher energy levels called excited states. However, since electrons like to have low energies whenever possible, they eventually return to their original orbitals.

As you’ve learned, energy can never be created or destroyed. Since this is true, what happened to the energy the electron absorbed when it jumped to the excited state? It has to go somewhere!

When electrons return to the ground state, energy is released from the atom as light. The color of the emitted light corresponds to the amount of energy it has. In our case, the amount of energy corresponds exactly to the difference in energy between the ground and excited states. As a result, we can use the color of the light to determine the differences in the orbital energies.

Why is this important? The differences in energy between the ground and excited states are different for every element. As a result, when we see the light that’s given off by an atom, we can use the color of this light to tell us what element is present. If we don’t know what element is in a sample but have a good idea of the colors given off by all elements in the periodic table, all we need to do to identify our sample is find an element that matches the color of our unknown.

This is the basis for spectroscopy. Though the technology used in modern spectroscopy is far more advanced than what you can do in chemistry class, the idea is exactly the same: By comparing the colors of light given off by an unknown sample to the colors of light given off by known elements, you can determine the identity of the unknown.
# Flame Test Lab

<table>
<thead>
<tr>
<th>Scientific Process</th>
<th>Your Written Response</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Problem/Question</strong></td>
<td>How can you identify elements using the color of their flames?</td>
</tr>
<tr>
<td>(What is problem or question?)</td>
<td></td>
</tr>
<tr>
<td><strong>Research</strong></td>
<td></td>
</tr>
<tr>
<td>(Background information )</td>
<td>1) Why do different elements give off different colors when heated?</td>
</tr>
<tr>
<td></td>
<td>2) Why would it be impossible to ID all elements using this method?</td>
</tr>
<tr>
<td><strong>Hypothesis</strong></td>
<td></td>
</tr>
<tr>
<td>(answer for the problem. Must be testable)</td>
<td></td>
</tr>
<tr>
<td><strong>Materials/Procedure</strong></td>
<td></td>
</tr>
<tr>
<td>(What do you need and what will you do?)</td>
<td></td>
</tr>
<tr>
<td><strong>Independent variable—</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Dependent variable—</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Constants—</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Materials</strong></td>
<td>Bunsen burner</td>
</tr>
<tr>
<td></td>
<td>Forceps</td>
</tr>
<tr>
<td></td>
<td>Wood splints or nichrome wire loop</td>
</tr>
<tr>
<td></td>
<td>Distilled water in wash bottle</td>
</tr>
<tr>
<td></td>
<td>5 known solutions:</td>
</tr>
<tr>
<td></td>
<td>Calcium chloride</td>
</tr>
<tr>
<td></td>
<td>Potassium chloride</td>
</tr>
<tr>
<td></td>
<td>Lithium chloride</td>
</tr>
<tr>
<td></td>
<td>Sodium chloride</td>
</tr>
<tr>
<td></td>
<td>Copper chloride</td>
</tr>
<tr>
<td></td>
<td>3 unknown solutions (A-C)</td>
</tr>
<tr>
<td></td>
<td>Watch glass</td>
</tr>
<tr>
<td><strong>Procedure – Copy from textbook page 119.</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Data</strong></td>
<td></td>
</tr>
<tr>
<td>(Recording the results)</td>
<td></td>
</tr>
<tr>
<td><strong>Substance:</strong></td>
<td><strong>Flame Color:</strong></td>
</tr>
<tr>
<td>CaCl₂</td>
<td></td>
</tr>
<tr>
<td>KCl</td>
<td></td>
</tr>
<tr>
<td>LiCl</td>
<td></td>
</tr>
<tr>
<td>NaCl</td>
<td></td>
</tr>
<tr>
<td>CuCl₂</td>
<td></td>
</tr>
</tbody>
</table>
**Data Analysis**  
(Summary. What does the data say?)

1) What were each of the unknown substances?
2) Is there a relationship between the color of the solution and the color of the flame?
3) A forensic scientist does a flame test on a solution found at a crime scene. What might the scientist conclude if the flame turns green?

<table>
<thead>
<tr>
<th>Unknown Substance:</th>
<th>Substance:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>B</td>
</tr>
<tr>
<td></td>
<td>C</td>
</tr>
</tbody>
</table>

**Conclusion**  
(Does the data support the hypothesis? How/Why?)

**Sources of Error, Future, Reflection**  
(What might have gone wrong? What would you do differently next time?)

1) What do you think would happen if the splints became contaminated? Why?
2) What are some other materials you might test using this method?