Quantum Theory

"You have reached the Heisenberg Institute. Your call will be answered in random order."

Name_________________

Quiz Date ____________

Test Date______________
Quantum Theory

Light: Is it a wave or particle?

**Wave Properties:**
Velocity: (  )

Frequency: (  )

Wavelength: (  )

Amplitude: (  )

**Types of Electromagnetic Radiation**

All Electromagnetic Radiation travels at the _______________ _______________ (c) = _________________ in a vacuum

Waves with low energy have a __________ frequency and a __________ wavelength

Waves with high energy have a __________ frequency and a __________ wavelength
E vs. λ vs. ν

Direct relationship - _______________________________________
Inverse relationship - _______________________________________

Answer the following using the EM spectrum in your reference packet
1) Which type of wave has the greatest frequency?

2) In the visible spectrum, which color has the lowest energy?

3) Between x-rays and microwaves, which one has the highest frequency?

Analyze the picture below in regards to energy, frequency and wavelength. Label which wave has the highest/lowest frequency, highest/lowest wavelength, and highest/lowest energy.

Key Vocabulary:

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground State</td>
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<tr>
<td>Excited State</td>
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<tr>
<td>Quantum</td>
<td></td>
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<tr>
<td>Photon</td>
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</tbody>
</table>
The Photoelectric Effect: __________________________________
_______________________________________________________
_______________________________________________________

Bohr Model of the Atom

Useful only for the element _______________

Assumptions of the Bohr Model:
1. 

2. 

3. 

Light as a Particle

In the Bohr model of the atom the electron can only have certain energy values. The energy values are quantized.

Image Credit: Wiki Commons / Brighterorange
*Electrons move from the ____________ _____________ to ____________ ___________ when they absorb energy. They then drop from the ____________ _____________ to the ____________ ___________ and release a ______________.

Define It:

Atomic Emission Spectrum:

Absorption Spectrum:

Spectroscopy:

Try It: using the Bohr Diagram
1) When the electron goes from n=4 to n=1 what portion of the EM spectrum is viewed?

2) When the electron moves from n=6 to n=3 what portion of the EM spectrum is viewed?

3) What color is emitted when the electron moves from n=3 to n=2?

Orbital Diagrams and Electron Configuration:
Orbitals: 3-D region where electrons are located

Sublevels: energy level in which the orbitals are located
**Note – Sublevel Locations on the Periodic Table:**

<table>
<thead>
<tr>
<th>Energy Level</th>
<th>Sublevel</th>
<th># of Orbitals</th>
<th># of Electrons</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1s</td>
<td>1</td>
<td>2</td>
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<tr>
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</table>

**Sublevels - # of Orbitals and Electrons**

- **s Sublevel** –
- **p Sublevel** –
- **d Sublevel** –
- **f Sublevel** –

*Each orbital can only hold a maximum of _________________!*  

**Electron Configuration**

*Format = #letter#*
- `# = energy level`
- `Letter = sublevel`
- `Superscript #: # of electrons`

Use the periodic table as your guide

Important Rules with the “d” and “f” block __________________________

________________________________________________________

________________________________________________________
**Electron Configuration Practice Problems:**
Example: O

Example: K

Example: Ni

Example: Te

**Noble Gas Electron Configuration**
This is a short-hand version of electron configuration

*Format:* 
[X]……

X = noble gas that comes directly before the element numerically

…. = the rest of the electron configuration from that noble gas to the element

**Noble Gas e- Configuration Practice Problems:**
Example: O

Example: K

Example: Ni

Example: Te
**Rules for Determining Orbital Diagram/Notation:**

1) Electrons must fill up the lowest energy level first

2) Electrons must fill up each sublevel in an energy level before pairing up

3) Each electron must have opposite spin in the same orbital.
Orbital Notation Practice Problems:

Example: O

Example: K

Example: Ni

Example: Te