**Bohr Model of the Atom** page 90-93 Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1)Scientists constructed model of the atom using the information that they had gained through experiments. They knew, for example, that an atom has a densely \_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_ that is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ charged.

|  |  |
| --- | --- |
| 2) What is inside the nucleus?  3) Why would it be charged at all?  4) What’s outside the nucleus?  5) What is the charge outside the nucleus? | [http://www.chem4kids.com/files/art/atom_struct1.gif](http://www.google.com/url?sa=i&rct=j&q=&esrc=s&frm=1&source=images&cd=&cad=rja&docid=J3jAO_bEqe65aM&tbnid=v6eiWCIv2PbmJM:&ved=0CAUQjRw&url=http://www.chem4kids.com/files/atom_structure.html&ei=qgBHUsD6FfTk4AOt44GwDg&bvm=bv.53217764,d.dmg&psig=AFQjCNH__KjRRkrJdrLIl7ZxuOI_ZEO0tQ&ust=1380471220500118) |

6) Scientists knew that any model of the atom may have to be modified or \_\_\_\_\_\_\_\_\_\_\_\_ as new information was found. The Rutherford model was replaced by a model developed by \_\_\_\_\_\_\_\_\_\_\_, that describes the electrons in terms of their \_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

|  |  |  |  |
| --- | --- | --- | --- |
| 7) According to Bohr, electrons can only be \_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_ from the nucleus.  ***\*\*NOTE: shells = energy levels***  8) Each distance corresponds to \_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  close to the nucleus= \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  farther from the nucleus= \_\_\_\_\_\_\_\_\_\_\_\_\_  9) The difference in \_\_\_\_\_\_\_\_\_\_\_ between two levels is known as a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of energy, and these are the discrete units in which energy exists. | |  | |
| 10) Which of the lettered diagrams below represents a Bohr model of an atom? |  | | 11) The \_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_  can be compared to rungs of a  ladder. | |
|  |  | | 12) On the first rung, that  represents the \_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_.  13) A person cannot stand  \_\_\_\_\_\_\_\_\_\_\_\_\_\_ the rungs  on the ladder and likewise the electrons cannot have a  continuous range of \_\_\_\_\_\_\_\_\_\_.  14) Bohr’s model states that  the \_\_\_\_\_\_\_\_\_\_\_ can only be  in one \_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_  or another, not \_\_\_\_\_\_\_\_\_\_\_\_. | |

15) Bohr also concluded that an electron did not \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ while in a given energy level.

**ELECTRONS ACT LIKE BOTH PARTICLES AND WAVES page 91**

16) In 1924, de Broglie pointed out that the behavior of electrons \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. ***This is called the Wave-Particle Duality of Electrons***.

17) Scientists knew that any \_\_\_\_\_\_\_\_ confined in space can have only certain \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

18) De Broglie suggested that \_\_\_\_\_\_\_\_\_\_\_\_\_ could be considered \_\_\_\_\_\_\_\_\_\_\_\_\_\_ confined to a space \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and therefore only have certain \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

19) These \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ correspond to the specific \_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ where the electrons are found.

20) The present day model of the atom takes into account both the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and the \_\_\_\_\_\_\_ properties of the electrons. According to this model the electrons are found in \_\_\_\_\_\_\_\_\_\_\_\_\_.

21) From the definition above figure 17 page 91 An \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is a region in an atom where there is a high \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

22) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are sometimes called electron clouds and they correspond to **specific** energy levels. Note that electron clouds do not have sharp \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ because it only shows where the electrons are most \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_to be found. The text uses an analogy of the spinning \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of a \_\_\_\_\_\_\_\_\_\_\_ because you cannot tell where any one \_\_\_\_\_\_\_\_\_\_\_\_\_\_ is at a particular \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Turn to page 93

23) The visible spectrum (which is the light we can see) is only a tiny\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

24) The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ includes **X-rays, ultraviolet and infrared light, microwaves, gamma and radio waves as well as visible light**. Each of these waves is referred to as \_\_\_\_\_\_\_\_\_\_\_\_ although we cannot see these \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**Use your Chemistry Reference Tables** to find the correct arrangement of the waves in bold-faced print in #24. Now, arrange these waves from lowest frequency (longest wavelength) to highest frequency (shortest wavelength)

**\_\_\_\_\_\_\_\_\_> \_\_\_\_\_\_\_\_\_\_\_>\_\_\_\_\_\_\_\_\_\_\_>\_\_\_\_\_\_\_\_\_\_\_\_>\_\_\_\_\_\_\_\_\_\_\_>\_\_\_\_\_\_\_\_\_\_\_>\_\_\_\_\_\_\_\_\_**

|  |  |
| --- | --- |
| [http://salem.k12.va.us/staff/sjones/chemweb/electron/waves.gif](http://www.google.com/url?sa=i&rct=j&q=&esrc=s&frm=1&source=images&cd=&cad=rja&docid=V2e5SaD-KRNmwM&tbnid=fCD8SoIhkM6ThM:&ved=0CAUQjRw&url=http://salem.k12.va.us/staff/sjones/chemweb/electron/electron.htm&ei=uA1HUvjjCu254APE0IHIDg&bvm=bv.53217764,d.dmg&psig=AFQjCNEX2Stx0pKmA6bcqhS88bPokiFwuQ&ust=1380474646265020) | Please note: figure 19 page 93  The wavelength is the distance between waves and the frequency of the waves is how many wave cycles pass a certain point per unit of time.  Wavelength and frequency have a  ( direct / inverse ) relationship.  **E is the Energy and it has a direct relationship with frequency.** |

25) When an electric current is passed through a tube of hydrogen gas, a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_-colored \_\_\_\_\_\_\_\_\_\_\_\_\_\_ is seen.

26) A spectrum of only a few colors is called a \_\_\_\_\_\_\_\_\_\_--\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Experiments with other gases have shown that \_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_ has its own unique different pattern of colors in its \_\_\_\_\_\_\_\_\_\_\_\_-- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

27) In 1913 Bohr showed that hydrogen’s electron can move from a low \_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_ to a higher \_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ energy. Note: the lowest energy level an electron can occupy is called the *GROUND STATE*.

28) Electrons at a higher energy level are said to be in the *EXCITED STATE* and they are \_\_\_\_\_\_\_\_\_\_\_\_\_ so they move to a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ energy level by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ energy.

29) The energy is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in the form of light that has a specific \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. This means it also has a frequency that matches a type of light on the electromagnetic (EM) spectrum but it may not appear as a color we can see with our eyes.

30) Each time an electron moves from a particular energy level to a \_\_\_\_\_\_\_\_\_\_\_\_ energy level, it will \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ light of a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

***Completion- demonstrate your understanding of Bohr’s model of the atom by using the word bank to complete the passage below.***

**ground state excited state higher lower**

**direct inverse spectrum nucleus**

**electrons releases absorbing Niels Bohr**

**quanta probability clouds Wave/particle duality**

1. The atom has a positive region called the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

2. The negative particles are called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

3. The atom has fuzzy electron \_\_\_\_\_\_\_\_\_\_\_\_\_ that correspond to specific energy levels.

4. An *orbital* is a region where there is a high \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of finding an electron.

5. When you take de Broglie and Bohr’s model together you can see that electrons exhibit \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

6. Energy of moving electrons exists in discrete units called \_\_\_\_\_\_\_\_\_\_\_\_\_. (plural form)

7. The lowest energy level an electron can occupy is called the \_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_.

8. An electron can move to a higher energy level, or the \_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_, by \_\_\_\_\_\_\_\_\_\_\_\_\_\_ energy.

9. The electron is unstable at a higher energy level and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ energy in a pattern of a few colors called a line-emission \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

10. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ showed the relationship between the color of light emitted from electrified hydrogen gas and the movement of hydrogen’s electron.

11. There is a(n) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ relationship between wavelength and frequency and a(n) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ relationship between energy and frequency of light.

12. When an electron gains energy, it moves from the ground state to a \_\_\_\_\_\_\_\_\_\_\_\_\_ energy level.

13. The electron releases an amount of energy equal to the difference in energy levels (on an emission spectrum) when it moves to a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ energy level

***Use your Chemistry Reference Tables to determine the type of light emitted in each of these transitions:***

|  |  |  |
| --- | --- | --- |
| **Transition from energy levels**  **energy level = (n)** | **wavelength of light in nm**  **nanometers = 10-9 m** | **portion of EM spectrum emitted**  **IR, UV, or visible** |
| n=4 to n=3 | 1875 nm | infrared |
| n= 3 to n=1 |  |  |
|  | 656 nm |  |
| n=5 to n=3 |  |  |
|  | 97 nm |  |
| n= 6 to n= 2 |  |  |
|  | 486 nm |  |
| n= 2 to n=1 |  |  |
|  | 1094 nm |  |

**NOTE: 580 nanometers is the same as 580 x 10-9 m**

In proper scientific notation that would be 5.8 x 10-7 m. Use the EM Spectrum from your Reference Tables to verify that this is yellow light on the visible spectrum.

***Complete the table below to show your understanding of the visible light portion of the EM spectrum***

|  |  |  |  |
| --- | --- | --- | --- |
| **wavelength in nanometers** | **wavelength in meters** | **color of visible light** | **transition**  **(if given)** |
| ***580 nm*** | ***5.8 x 10-7 m*** | ***yellow*** | ***? 🡪 n=2*** |
| 410 nm |  |  |  |
| 656 nm |  |  |  |
| 486 nm |  |  |  |
| 434 nm |  |  |  |
|  | 4.2 x 10 -7 m |  |  |
|  | 5.1 x 10 -7 m |  |  |