WKS - Honors
Emission Spectra and The Bohr Atom

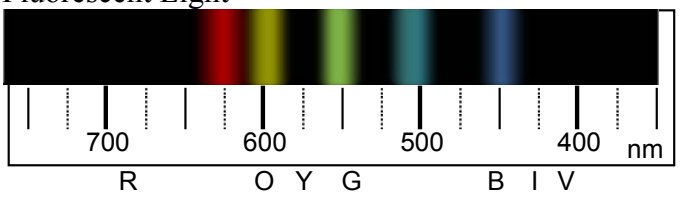
Name Answer Key
Period _____ **Date** _____

Emission Spectra:

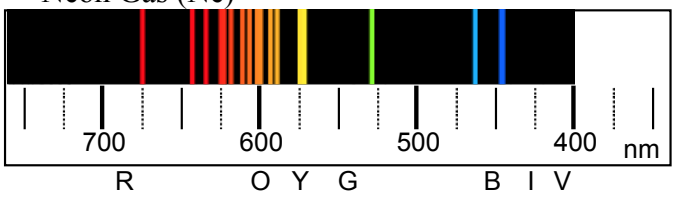
1) Describe what you see when you look at sunlight or other white light source through a spectroscope:
A continuous, smooth spectrum – like a rainbow.

2) For the following light sources, draw in the approximate spectra that you observe. (Draw vertical lines at the approximate wavelength and in the correct color.)

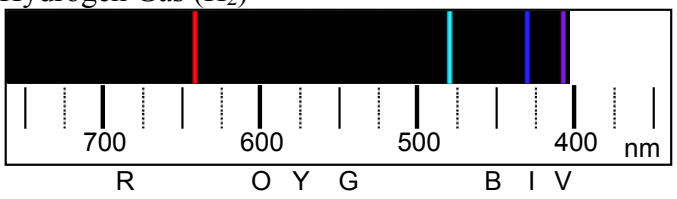
Fluorescent Light



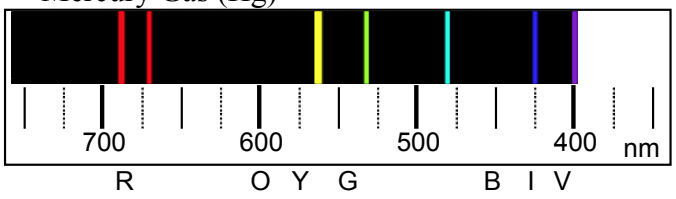
Neon Gas (Ne)



Hydrogen Gas (H_2)



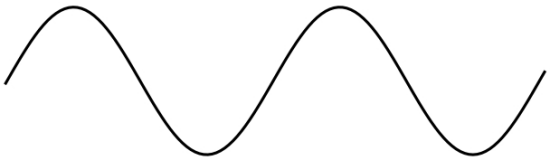
Mercury Gas (Hg)



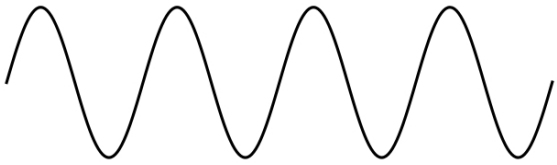
3) Based on the above spectra, what gas must be inside a fluorescent light bulb? ***Why?***
Mercury (Hg) is inside the fluorescent light—their spectra are most similar

Light as energy and waves:

4) Below are diagrams of two different waves of light. Compare the two light waves by circling the correct words.



(long, short) wavelength
(low, high) frequency
(low, high) energy



(long, short) wavelength
(low, high) frequency
(low, high) energy

5) Answer the following general questions about spectroscopy and light:

a) Which has a shorter wavelength — red light or violet light? violet

b) As the wavelength gets longer, does the frequency get higher or lower? lower

c) Which has a higher frequency— red light or violet light? violet

d) As the frequency increases, does the energy increase or decrease? increases

e) Which is more energetic— red light or violet light? violet

The Bohr Atom: Analysis of emission spectra

6) Electrons are attracted to the nucleus. Why?
They are negatively charged and attracted to the positive nucleus by electrostatic attraction.

7) Since electrons are attracted to the nucleus, it is relatively difficult to move an electron further away from the nucleus. Thus, when an electron does move further away from a nucleus, energy must be:

a) absorbed by the electron b) released by the electron

8) Thus, when an electron moves further away from the nucleus, the electron must:

a) gain potential energy b) lose potential energy

9) Earlier, you looked at the emission spectra produced when electricity was passed through tubes filled with various gases. Answer the following questions about how electrons are involved with producing the light.

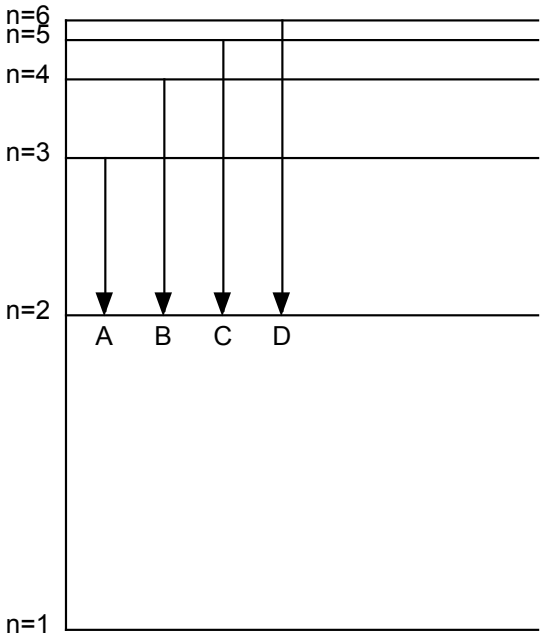
a) When electricity is passed through a gas, some electrons in the atoms of gas absorb the energy. What must happen to the energy of the electrons when they **absorb** this energy?
The electrons' energy must *increase*. The electrons get *excited*.

b) Describe what naturally happens to the electrons next. Explain why light is emitted.
The electrons are attracted back towards the nucleus and *relax* to a lower energy level. As they lose energy, this energy is emitted in the form of one photon of light.

10) Refer to the diagram on the right to answer these questions.

a) Which jump releases the LEAST energetic light waves?
Jump A

b) Suppose that an emission spectrum has four lines with the colors below. Each colored line corresponds to an electron jump. Use what you have learned about differences in energy levels and the relationship between wavelength and energy to match the correct jump with its corresponding color by writing in the correct letter next to each color.



COLOR	LETTER
RED	A
YELLOW	B
GREEN	C
BLUE	D

11) In Bohr's model of the atom, electrons are quantized. This means that electrons can only occupy certain energy levels. Why does the emission spectra of gases support this model of the atom? Explain exactly what evidence these line spectra provide. How is this different from the continuous spectrum observed from the sun or other white light source?
Since only certain energy *differences* are observed, then only certain energy values are allowed. In a continuous spectrum of white light, the energy levels are so close together that essentially every energy is observed.