Shedding Light on Atoms Episode 6: Electron Shells **Name: _____**

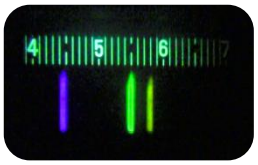
Part A

1. Atoms are made of three subatomic particles: _____, _____, and _____.
2. _____ and _____ make up the nucleus of an atom while _____ orbit around the nucleus.
3. The atomic number of boron, B, is 5 and so, by definition, every boron atom has _____ protons in its nucleus. Iron atoms have _____ protons in their nucleus and so they have an atomic number of _____.

Part B

4. Lithium chloride, sodium chloride, and barium chloride are all different types of "salts", and they all look very similar to each other. Describe an easy way of telling them apart.

_____
_____
_____
_____



5. An element's emission spectrum is the set of wavelengths of light that it emits when it is in the form of a low-pressure hot gas. In what way is an emission spectrum like a human fingerprint?

_____
_____
_____

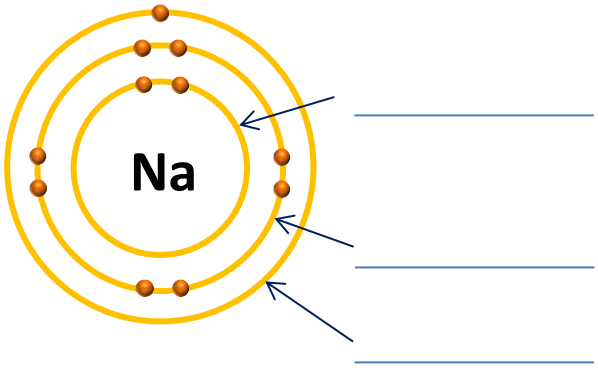
6. The top emission spectrum on the left comes from _____ while the bottom emission spectrum on the left comes from _____.

Part C

7. In 1913, Danish scientist Neils Bohr suggested that electrons can occupy only certain energy levels which were named _____ _____.
8. According to Bohr's theory, how is light produced by atoms in discharge tubes (and in flame tests)?

_____
_____
_____
_____

Part D



9. Label sodium's electron-configuration diagram on the left.

10. Fill in the table below.

Shell Number	Maximum Number of Electrons
1	
2	
3	

11. What is the electron configuration of sodium (Na)?

_____

12. Fill in the electron configurations of the elements in the table below. Carbon's has already been done.

The Periodic Table: Element Name, Element Symbol, Atomic Number, Electron Configuration.

	Group 1	Group 2	Group 13	Group 14	Group 15	Group 16	Group 17	Group 18
Period 1	hydrogen H, 1 _____							helium He, 2 _____
Period 2	lithium Li, 3 _____	beryllium Be, 4 _____	boron B, 5 _____	carbon C, 6 **2, 4**	nitrogen N, 7 _____	oxygen O, 8 _____	fluorine F, 9 _____	neon Ne, 10 _____
Period 3	sodium Na, 11 _____	magnesium Mg, 12 _____	aluminium Al, 13 _____	silicon Si, 14 _____	phosphorus P, 15 _____	sulfur S, 16 _____	chlorine Cl, 17 _____	argon Ar, 18 _____

13. Draw electron-configuration diagrams for hydrogen, carbon, and oxygen atoms.

hydrogen, H	carbon, C	oxygen, O

14. The atoms of all (both) elements in Period 1 have _____ electron shell, the atoms of all elements in Period 2 have _____ electron shells, and the atoms of all elements in Period 3 have _____ electron shells.
15. What does the **Period number** (that an element is in) tell you?

_____

_____

16. The atoms of the elements in Groups 1 & 2 and 13-18 have a specific number of electrons in their outer shell. Fill in the rest of the table below. (The Group number is NOT necessarily the same as the number of electrons in an atom's shell.)

Group Number	No. of Electrons in the Outer Shell
1	**1**
2	
13	**3**
14	
15	
16	
17	
18	

17. All the atoms of the **Group 18** elements have _____ electrons in their outer shell, except for helium atoms. Why is helium placed into Group 18?

_____

_____

_____

18. The atoms of most **transition metals** (metals in Groups 3 to 12) have either _____ or _____ electrons in their outer shells.
19. Palladium atoms have an electron configuration of _____. However, the atoms of every other element never have more than _____ electrons in their outer shell.
20. Fill in the table below. You will need a periodic table.

Element	Element Symbol	Number of Electron Shells	Group Number	Number of Electrons in the Outer Shell
Barium				
	Te			**6**
Bromine				
Lead				
		6	**16**	
		5		**4**

21. Potassium, K, has an electron configuration of _____ and Calcium, Ca, has an electron configuration of _____.

Part E

22. What is a picometre (pm)?

_____

_____

23. In picometres, what is the approximate diameter of an iron (Fe) atom? _____
24. Why can't an exact diameter of a single atom be measured?

_____

_____

25. The earth has a diameter of 12, 742 km. Exactly how many times wider is this than a solid iron sphere with a diameter of 6 cm?

(Note 1: You will need to **change both lengths into metres** before you do the calculation. Note 2: Your answer will also be the approximate number of iron atoms in a straight line going from one side of the iron sphere to the other. Note 3: This is different to the actual number of atoms in the sphere which is about 8.7 trillion trillion!)