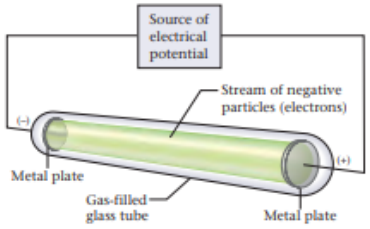
3.3 Atomic Structure
Chemistry
Problem Set

Name:_____ Date:_____

Problem-Set Directions: All answers must be put on a separate piece of notebook paper. Do not recopy the question. Answer all open-ended questions in complete sentences. For math questions, show all of your work and include appropriate units and significant figures in your final answer to receive **FULL** credit.

1. Indicate whether each of the following statements is true or false. If a statement is **false, correct the statement** so that it becomes true.

    a. In his cathode ray tube experiments, J. J. Thomson obtained beams of different types of particles whose nature depended on which gas was contained in the tube.



    b. Thomson assumed that the atom must contain positively charged particles because isolated atoms have no overall charge.

    c. In the plum pudding model of the atom, the atom was envisioned as a sphere of negative charge in which positively charged electrons were randomly distributed.

2. Indicate whether each of the following statements is true or false. If a statement is **false, correct it so that it becomes true**.

    a. Rutherford's bombardment experiments with metal foil suggested that alpha particles were deflected by approaching a large, negatively charged atomic nucleus.

    b. The proton and the electron have similar masses but opposite electrical charges.

    c. Most atoms also contain neutrons, which are slightly heavier than protons but carry no charge.

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3. What uncharged particles are found in the nuclei of most atoms? _____
4. What are the positively charged particles found in the nuclei of atoms called? _____
5. What are the negatively charged particles found in the nuclei of atoms called?_____
6. Do the proton and the neutron have exactly the same mass? _____
7. How do the masses of the proton and the neutron compare with the mass of the electron?

8. Which particles make the greatest contribution to the mass of an atom? _____
9. Which particles make the greatest contribution to the chemical properties of an atom?

   _____
10. Although the nucleus of an atom is very important, it is the _____ that determines its chemical properties.
11. _____ **True or false**? Atoms that have the same number of neutrons but different numbers of protons are called isotopes.

12. _____ **True or false**? The mass number of a nucleus represents the number of protons in the nucleus.

13. How was Dalton's atomic theory modified after the discovery that several isotopes of an element may exist?

14. Are all atoms of the same element identical? If not, how do they differ?

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15. For each of the following elements, use the periodic table on the inside back cover of this book to write the element's atomic number.

    a. Ge _____ b. Sr _____ c. zinc _____ d. cobalt _____

    e. Cr _____ f. Be _____ g. tungsten _____ h. lithium _____

16. Write the symbol notation, $^{A}_{Z}\mathbf{X}$ for each of the isotopes described below.

    a. Z = 8, number of neutrons = 9 _____

    b. the isotope of chlorine in which A = 37 _____

    c. Z = 27, A = 60 _____

    d. number of protons = 26, number of neutrons = 31 _____

    e. the isotope of I with a mass number of 131 _____

    f. Z = 3, number of neutrons = 4 _____

17. How many protons, electrons, and neutrons are contained in the nucleus of each of the following atoms?

Element	Mass number	protons	electrons	neutrons
Pu	244			
Am	241			
Ac	227			
Cs	133			
Ir	193			
Mn	56			

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18. Complete the following table

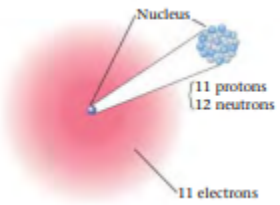
Name	Symbol notation	Atomic Number	Mass Number	Neutrons
sodium			23	
nitrogen			13	
barium			136	
lithium			9	
boron			11	

19. Can atoms of two different elements have the same atomic number? Explain

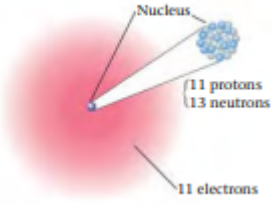
20. Could they have the same mass number? Explain.

21. Use the following figures to identify the element or ion. Write the symbol for each, using the ${}^{A}_{Z}X$ format.

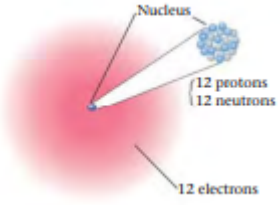
a.



b.



c.



a. _____ b. _____ c. _____

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22. **Choose** the statement that best answers this question:

    If all atoms are composed of the same subatomic particles, why do different atoms have different chemical properties? Explain your choice.

    a. The number and arrangement of the electrons matter most because the electrons of the atoms “intermingle” when atoms combine to form molecules.

    b. The number and arrangement of the electrons matter most because the electrons of the atoms are located in the nucleus, and the nucleus is involved in chemical reactions.

    c. The number and arrangement of the protons matter most because the protons of the atoms “intermingle” when atoms combine to form molecules.

    d. The number and arrangement of the protons matter most because the protons of the atoms are located in the nucleus, and the nucleus is involved in chemical reactions.